Soils Infiltration Data for Selected Wyoming Watersheds, 1998-1999

By Kirk Miller, John Elliott, and Nolan Friday

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U.S. Department of the Interior
Gale A. Norton, Secretary

U.S. Geological Survey
P. Patrick Leahy, Acting Director

Contents

Figures

Tables

Conversion Factors and Datum

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.281	foot (ft)
	Area	
square centimeter (cm^2)	0.155	square inch (in^2)
	Volume	
liter (L)	0.26	gallons (gal)
milliliter (mL)	0.026	gallons (gal)
	Mass	
kilogram (kg)	2.205	pound, avoirdupois (lb)
	Flow rate	
centimeters per hour (cm/hr)	0.3937	inches per hour (in/hr)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8×°C)+32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C=(°F-32)/1.8$$

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)

Soils Infiltration Data for Selected Wyoming Watersheds, 1998-1999

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Abstract

Soils infiltration data collected during 1998-1999 are summarized for watersheds near Cheyenne, Casper, Sheridan, and Gillette, Wyoming. Incremental infiltration rates are calculated for each infiltration test from flow-rates needed to maintain a constant head in a double-ring infiltrometer. Site vegetative cover and condition, soil antecedent moisture condition, and published soils data are summarized for each test site.

Introduction

The Wyoming Department of Transportation (WYDOT) uses mathematical models to design and evaluate bridges and culverts. Various climatologic, physiographic, hydrologic, and hydraulic data are required as model input and for model calibration. Soils infiltration data can be used for model calibration. In addition, soils infiltration data are useful for other hydrologic analyses and models employed by the U.S. Geological Survey (USGS). In cooperation with the WYDOT, the USGS collected infiltration and relevant ancillary data for selected watersheds in Wyoming in 1998 and 1999.

Purpose and Scope

This report presents soils infiltration data measured at 23 sites in seven Wyoming watersheds during 1998 and 1999. Incremental infiltration rate data tables and plots are included as appendixes. Site soil names and hydrologic soil groups are from the U.S. Department of Agriculture (USDA) (1995, 1997, 1998, 2005a, 2005b). Vegetation cover and condition information are field observations recorded at the time the infiltration measurements were made. Further reduction, analysis, and interpretation of these data are beyond the scope of this report.

Previous Investigations

The USGS previously has collected infiltration data in Wyoming. Infiltration data for "a variety of wild natural undisturbed soils in Colorado, Wyoming, and Montana" are summarized in McQueen (1963). Data were collected using a USGS-designed rainfall-simulator infiltrometer ("microrainulator"). Mean infiltration rates from four or more tests averaged over the 40- to 60-minute test intervals ranged from 0.58 in/hr (1.5 cm/hr; shale-soil type) to 3.64 in/hr (9.2 cm/hr; sandy-soil type).

Rankl (1990) also measured infiltration rates using the USGS microrainulator described by McQueen (1963). The data were collected from two watersheds for comparison of infiltration rates within a basin. Adjusted (for lateral movement) incremental infiltration rates ranged from 0.61 in/hr (1.5 cm/hr; silty clay to clay loam) to 0.82 in/hr (2.1 cm/hr; fine sandy-loam) after 1 hour.

Infiltration data previously have been collected in Wyoming by others. In particular, Abdel-Magid and others (1987) summarized infiltration data from 1983-1984 in an area also tested during this study. Mean infiltration rates determined from the final 30 minutes of the 2-hour tests ranged from 3.1 to 4.0 in/hr (7.87 to 10.15 cm/hr; sandy loam). Frasier and others (1995) studied infiltration characteristics at the same site in 1993; those data were not available at the time of this study. The USDA Natural Resources Conservation Service (NRCS) has more information on these and other infiltration data collected in Wyoming.

Acknowledgements

Methods

Infiltration data were collected from seven small water-sheds across the State. Those watersheds were Childs Draw, Allison Draw, and Dry Creek (Cheyenne); Garden Creek (Casper); Little Goose Creek (Sheridan); and Stonepile and Donkey Creeks (Gillette). One or more sites representative of the dominant physical characteristics of each watershed were selected based on field reconnaissance. Access also was a primary consideration in site selection; areas were selected to minimize effects to private landowners and maximize future data collection efforts. Data were collected at two to three locations in each watershed. Where possible, site locations were determined using a global positioning satellite (GPS) unit. Site locations are shown in figure 1; map and site identi-fiers, location data, and test dates for each watershed are listed in table 1.

A general description of each site was prepared. Soils information for each site was obtained from NRCS published or digital sources. Mapping units, or mapping unit identifiers (MUIDs) were determined by plotting each site location on NRCS soils maps. Using the MUID, the soil name (or other taxon) and slope range were determined from related attribute tables. Field observations of vegetation type and condition were recorded. Soils information and field observations for the test sites are listed in table 2.

Hydrologic soil groups were determined from related attribute tables by using the MUID. Soils are classified into hydrologic soil groups by the minimum infiltration rate obtained for bare soil after prolonged wetting (U.S.Department of Agriculture, 1986). For complex soil names, the convention is to list the dominant soil first. The hydrologic soil group list-ing follows the same convention. Relative infiltration rates and general descriptions of soil hydrologic properties as defined by the NRCS are presented in table 3 for the reader's conve-nience.

Soil moisture content is important in evaluating infil-tration data. Quantitative soil moisture content was not determined for each site. However, field observations were compiled and equivalent NRCS qualitative antecedent soil moisture conditions (AMC) (table 4) were determined. For all the infiltration tests except BR1, a soil moisture condition

Table 1.   Locations, identifiers, and dates of infiltration tests.

[Map identifier references figure 1; Location latitude and longitude in degrees minutes seconds; N/A, not applicable; —, no data.]

Nearest town	Map identifier	Watershed	Site identifier	Location Latitude	Location Longitude	Relative location	Date
Cheyenne	1	Allison Draw	AD1	41 04 23.46	104 50 16.16	N/A	09/15/1998
Cheyenne	2	Allison Draw	AD2	41 04 23.41	104 50 14.52	~130 ft NE of AD1	09/16/1998
Cheyenne	3	Allison Draw	AD3	41 04 23.41	104 50 14.52	36 ft NE of AD2	09/16/1998
Cheyenne	4	Childs Draw	ARS1	41 12 40.49	104 51 14.96	N/A	09/17/1998
Cheyenne	5	Childs Draw	ARS2	41 12 40.49	104 51 14.96	22 ft NE ARS1	09/17/1998
Cheyenne	6	Childs Draw	ARS3	41 12 40.49	104 51 14.96	40 ft NE of ARS2	09/18/1998
Cheyenne	7	Dry Creek	BR1	41 10 36.94	104 47 35.70	N/A	09/22/1998
Cheyenne	8	Dry Creek	BR2	41 10 36.94	104 47 35.70	30 ft NW of BR1	09/23/1998
Cheyenne	9	Dry Creek	BR3	41 10 36.94	104 47 35.70	50 ft NE of BR1	09/23/1998
Cheyenne	10	Dry Creek	AFB1	41 11 13.94	104 51 04.16	N/A	09/24/1998
Cheyenne	11	Dry Creek	AFB2	41 11 13.94	104 51 04.16	~25 ft SW of AFB1	09/24/1998
Casper	12	Garden Creek	GC1	42 47 35	106 20 36	N/A	09/15/1999
Casper	13	Garden Creek	GC2	42 47 35	106 20 36	20 ft N of GC1	09/16/1999
Casper	14	Garden Creek	GC3	42 47 35	106 20 36	—	09/16/1999
Sheridan	15	Little Goose Creek	LG1	44 39 38	106 57 21	N/A	09/20/1999
Sheridan	16	Little Goose Creek	LG2	44 39 38	106 57 21	20-25 ft SE of LG1	09/20/1999
Sheridan	17	Little Goose Creek	LG3	44 36 21	107 02 15	—	09/21/1999
Sheridan	18	Little Goose Creek	LG4	44 36 21	107 02 15	—	09/21/1999
Gillette	19	Donkey Creek	DC1	44 15 43	105 30 43	N/A	09/29/1999
Gillette	20	Donkey Creek	DC2	44 15 43	105 30 43	50 ft N of DC1	09/29/1999
Gillette	21	Stonepile Creek	SP1	44 17 46	105 34 27	Within 150 ft of creek	09/29/1999
Gillette	22	Stonepile Creek	SP2	44 17 46	105 34 27	25 ft streamward of SP1	09/29/1999
Gillette	23	Stonepile Creek	SP3	44 17 46	105 34 27	25 ft shoreward of SP1	09/29/1999

equivalent to AMC I can be assumed. An equivalent soil mois-ture condition between AMC II and AMC III can be assumed for BR1 because of light rain and cool temperatures for the 2 days prior to the test and the day of the test.

The equipment and procedures used to collect the infil-tration data were in accordance with American Society for Testing and Materials (ASTM) guidance. The WYDOT speci-fied that the infiltration data was to be collected using a ring infiltrometer. Although generally accepted, problems are asso-ciated with ring infiltrometers relative to collecting representa-tive infiltration data. Some modifications to equipment design and data-collection procedures were made for this study with the intent of addressing these problems. These modifications

are described, and supporting references are noted in the fol-lowing paragraphs.

To promote vertical infiltration (that is, to mitigate the effects of lateral divergence), a double-ring infiltrometer design was used (American Society for Testing and Materials, 1994). The design was modified by increasing the inner-ring diameter from the commonly cited 12 in. (~30 cm) to ~24 in. (~45 cm); the outer-ring diameter was increased accordingly. Larger diameter rings minimize lateral infiltration (Klute, 1986). For reference, the effective ring diameter of the previ-ously noted investigations by McQueen (1963), Rankl (1990), and Abdel-Magid and others (1987) were 6.18 in. (15.7 cm), 5.75 in. (14.6 cm), and 11.8 in. (30.0 cm) respectively. Speci-

Base map modified from U.S. Geological Survey Digital Line Graph (DLG) data, 2003-04
Highways modified from Federal Highway Administration and the Bureau of Transportation
Statistics National Transportation Atlas Databases, 2002
Albers Equal-Area Conic projection
Standard parallels 29°30′ and 45°30′, central meridian -107°30′

EXPLANATION

●**1,2,3** Infiltration test sites and numbers

Figure 1.   Location of infiltration test sites, Wyoming, 1998-99.

fications for the rings are shown in figure 2. The exact area of
the inner ring after construction was 458.0 in^2 (2,955 cm^2).

Table 2.   Description of infiltration test site soil and vegetation properties.

[Soil name and hydrologic soils group(s) from U.S. Department of Agriculture (1997, 1998, 2005a, 2005b); do., ditto (indicates that the entry above it is repeated); --, no data.]

Site identifier	Soil name	Hydrologic soil group(s)	Observed vegetation	Comments
AD1	Poposhia-Trimad complex, 3 to 15 percent slopes	B/D	Prickly pear cactus, Fringed sagewort, Blue grama, Needleandthread grass, Threadleaf sedge	Site on ridge; cobble/gravel outcrop within 25 ft
AD2	Do.	Do.	Prickly pear cactus, Fringed sagewort, Blue grama, Needleandthread grass, Threadleaf sedge	More grass/less rock relative to AD1; no evidence of recent grazing
AD3	do.	do.	Prickly pear cactus, Fringed sagewort, Blue grama, Needleandthread grass, Threadleaf sedge	More grass/less rock relative to AD1; no evidence of recent grazing
ARS1	Evanston loam, 0 to 6 percent slopes	B	Prickly pear cactus, Blue grama, Junegrass, Fringed sagewort, Needleandthread grass, Thistle	--
ARS2	do.	do.	Prickly pear cactus, Blue grama, Junegrass, Fringed sagewort, Needleandthread grass, Thistle	Very light grazing
ARS3	do.	do.	Prickly pear cactus, Blue grama, Junegrass, Fringed sagewort, Needleandthread grass, Thistle	Very light grazing
BR1	Poposhia-Trimad complex, 3 to 15 percent slopes	B/D	Needleandthread grass, Threadleaf sedge, Blue grama, Big sage, Yucca, Western wheatgrass, Indian ricegrass, Red three-awn	No grazing/use (water tower exclosure)
BR2	do.	do.	Needleandthread grass, Threadleaf sedge, Blue grama, Big sage, Yucca, Bluebunch wheatgrass, Indian ricegrass, Red three-awn	No grazing/use (water tower exclosure)
BR3	do.	do.	do.	No grazing/use (water tower exclosure)
AFB1	Evanston loam, 0 to 6 percent slopes	B	Western wheatgrass, Tall dropseed, Junegrass, Needleandthread grass, Thistle, Winterfat, Fringed sagewort	--
AFB2	do.	do.	do.	--
GC1	Savageton-Samday complex, 3 to 15 percent slopes	C/D	Junegrass, Needleandthread grass, Cheatgrass, Western wheatgrass, Crested wheatgrass, Saltbush, Sagebrush, Rubber rabbitbrush, various annual weeds	Cobble/boulder and gravel
GC2	do.	do.	Junegrass, Silver sage, Cheatgrass, Needleandthread grass, Sagebrush, Saltbush, Rubber rabbitbrush, Crested wheatgrass	Heavy vegetation cover; no grazing
GC3	do.	do.	Junegrass, Needleandthread grass, Cheatgrass, Western wheatgrass, Crested wheatgrass, Saltbush, Sagebrush, Rubber rabbitbrush, various annual weeds	--

Table 2. Description of infiltration test site soil and vegetation properties.—Continued

Site identifier	Soil name	Hydrologic soil group(s)	Observed vegetation	Comments
LG1	Moskee sandy loam, 0 to 3 percent slopes	B	Hay, grain	Hay flat/bird habitat
LG2	do.	do.	do.	--
LG3	Platsher-Wolvar loams, 0 to 3 percent slopes	C/B	Grasses, few forbs	Flat rangelands; little to no grazing
LG4	Do.	Do.	Do.	Do.
DC1	Aridic ustorthents[1], 0 to 4 percent slopes	B	Smooth brome, Crested wheatgrass, Sagebrush, Wild rose, Junegrass, Western wheatgrass	Little to no use
DC2	do.	do.	do.	Little to no use
SP1	Emigha[2], 0 to 3 percent slopes	B	Mostly grasses: Crested wheatgrass, Smooth brome, Western wheatgrass; some Fringed sagewort	No use
SP2	do.	do.	do.	--
SP3	do.	do.	do.	--

1) Taxon above Family.

2) Series.

Table 3. Description of Natural Resources Conservation Service's hydrologic soil groups.

[Source: U.S. Department of Agriculture (1995).]

Hydrologic soil group	Description
A	High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.
B	Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.
C	Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.
D	Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Table 4. Description of Natural Resources Conservation Service's antecedent soil moisture conditions.

[Source: Novotny and Olem (1994).]

Antecedent soil moisture (AMC) condition	Description
AMC I	A condition of watershed soils where the soils are dry but not to the wilting point, and when satisfactory plowing or cultivation takes place.
AMC II	The average case for annual floods, that is, an average of the conditions that have preceded the occurrence of the annual flood on numerous watersheds.
AMC III	If heavy rainfall or light rainfall and low temperatures have occurred during the 5 days prior to the given storm and the soil is nearly saturated.

For each test, the rings were driven into the soil a minimum of 2 in. (5 cm) (Klute, 1986) and a maximum of 6 in. (15 cm) (American Society for Testing and Materials, 1994; Johnson, 1963). Deeper penetration may result in increased soil disturbance (Klute, 1986). The rings were driven into the soil using the driving cap (fig. 2). A large timber was laid across the cap and struck with a sledge hammer. The timber was moved around the cap to facilitate driving the rings into the soil vertically. Alternatively, the rings were jacked into the soil using a vehicle and a high-lift jack. Even though the jacking method is preferred (American Society for Testing and Materials, 1994), it was not always possible for the conditions encountered during this study.

Water for the infiltration tests was supplied by two containers (fig. 3). A 50-L polyethylene carboy was used to supply water to the inner ring. Water for the outer ring was supplied by a separate, larger non-metallic container. Sources for the water in each container were local municipal supplies. A graduated sight tube was attached to the side of the 50-L carboy and calibrated by averaging multiple 250-mL withdrawals. To begin the infiltration test, the initial site tube reading and the time were noted and both rings were filled quickly to some arbitrary shallow depth generally between 2 to 3 in. (5 to 8 cm). Larger depths may result in higher infiltration rates (Klute, 1986). The test proceeded by maintaining this constant depth (head). For the inner ring, a float valve fixed to the side of the ring automatically maintained the constant head. For the outer ring, the constant head was maintained manually by periodically measuring the depth and adding more water as needed. Site tube readings were made periodically; initially, readings were noted every few minutes. The test continued until a base infiltration rate (Trout and others, 1982) was attained or until the inner ring water supply was exhausted.

Description of Infiltration Tests

Infiltration tests were completed on seven soils/soil complexes on slopes ranging from 0 to 15 percent. Hydrologic soil groups at these test sites ranged from B (moderate infiltration) to C/D (slow to very slow infiltration). Vegetation cover was typical of grasslands and rangelands of the High Plains and Powder River Basin, Wyoming. Incremental infiltration rates were calculated and plotted according to published guidelines (American Society for Testing and Materials, 1994) (Appendixes 1 and 2.). To facilitate comparison, the graphs were scaled the same for all tests. It should be noted that a few tests exceeded 3 hours elapsed time; although these data do not appear on the graphs, they are included in the tables.

Eleven tests were completed in three watersheds near Cheyenne during September 15-24, 1998. Three tests were completed in Allison Draw on an upland plateau southwest of Cheyenne (AD1, AD2, and AD3). Nearby outcrops of cobble and gravel were noted. All three tests were run past an apparent base infiltration rate. Three more tests were completed in Childs Draw on the USDA High Plains Grasslands Research Station north of Cheyenne (ARS1, ARS2, and ARS3). All three tests had not reached an apparent base infiltration prior to exhausting the water supply. The water supply to the inner ring was interrupted at about 2.8 hours elapsed time for test ARS3; after adjusting the supply hose, flow was restored and the test continued. Three more tests were completed on the Dry Creek side of Buffalo Ridge in the northern part of Cheyenne (BR1, BR2, and BR3). The test sites were within the water tower exclosure. All three tests were run past an apparent base infiltration rate. Light rain and cool temperatures occurred 2 days prior to and during the day of test BR1. Infiltration data from tests BR2 and BR3 compare well with each other. Another two tests were completed for the Dry Creek watershed near the eastern edge of F.E. Warren Air Force Base (AFB1 and AFB2). Both tests had not reached an apparent base infiltration prior to exhausting the water supply. The water supply to the inner ring was interrupted at about 1.5 hours elapsed time for test ARS2; after adjusting the supply hose, flow was restored and the test continued.

Three tests were completed in the Garden Creek watershed near Casper during September 15 and 16, 1999. Test sites GC1, GC2, and GC3 were located east of Garden Creek Road about 1 mile north of Wyoming Boulevard. An apparent base infiltration rate was not reached prior to ending any of the tests. A leak at the soil-ring interface developed during test GC1; data from this test are considered suspect.

Four tests were completed at two locations in the Little Goose Creek watershed near Sheridan during September 20 and 21, 1999. Test sites LG1 and LG2 were located on a Wyoming Game and Fish Department Bird Farm hay flat. Test sites LG3 and LG4 were located in a county road right-of-way near the Little Goose Ranch, about 6 miles south of Big Horn. Apparent base infiltration rates were approached near the end of all four tests.

Five tests were completed in two watersheds near Gillette on September 29, 1999. Tests DC1 and DC2 were located within 50 ft of Donkey Creek on Gillette High School property south of Gillette. Problems with the float valve near the end of both tests increased the inner-ring water levels. Infiltration data from the tests compare well with each other. Tests SP1, SP2, and SP3 were located within 150 ft of Stonepile Creek, about 2 miles east of Gillette. Problems with the float valve near the end of test SP2 increased inner-ring water levels. Apparent base infiltration rates were not reached prior to the end of any of the tests.

Centering holes

Driving cap

Specifications for driving cap:

1) Constructed of 1/4-inch (approximate) thick black iron or other heavy metal; cap may be constructed by joining multiple plates together to achieve desired thickness.

2) The cap shall have two sets of 8 holes for centering pins. The holes shall be 1/2-inch in diameter. One set shall be equally spaced along an arc of radius 11-1/2 inches measured from the center of the cap, such that centering pins in the holes will fit inside the inner ring. The other set shall be equally spaced along an arc of radius 14-1/2 inches.

36-inch diameter

Inner ring

12-inches deep

Double-ring infiltrometer

Specifications for rings:

1) Constructed of 1/8-inch (approximate) thick black iron or other heavy metal so as to withstand repeated driving into ground with a 1/2-lb sledge hammer.

24-inch inner diameter

2) Rings shall be riveted or welded at the joint so as to withstand repeated use; joint shall be water tight.

Outer ring

12-inches deep

30-inch inner diameter

Close-up of bevel on bottom edge of rings
Bottom of both rings shall be beveled from the outside-in to a 45-degree (approximate) point.

Figure 2. Schematic diagram and construction specifications for double-ring infiltrometer.
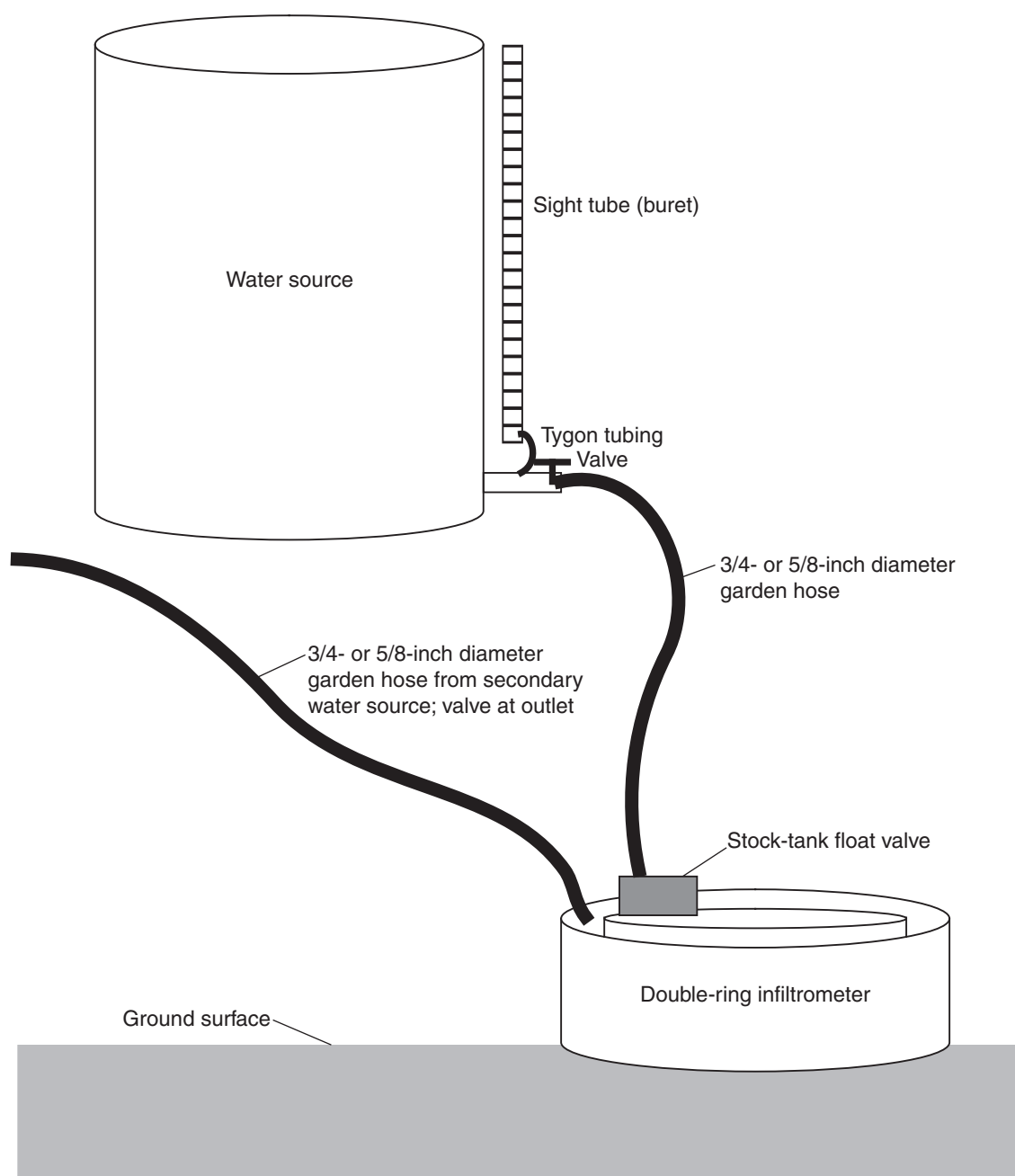
Figure 3.   Schematic of infiltration measurement equipment.

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Appendix 1.   Graphs of Infiltration Data
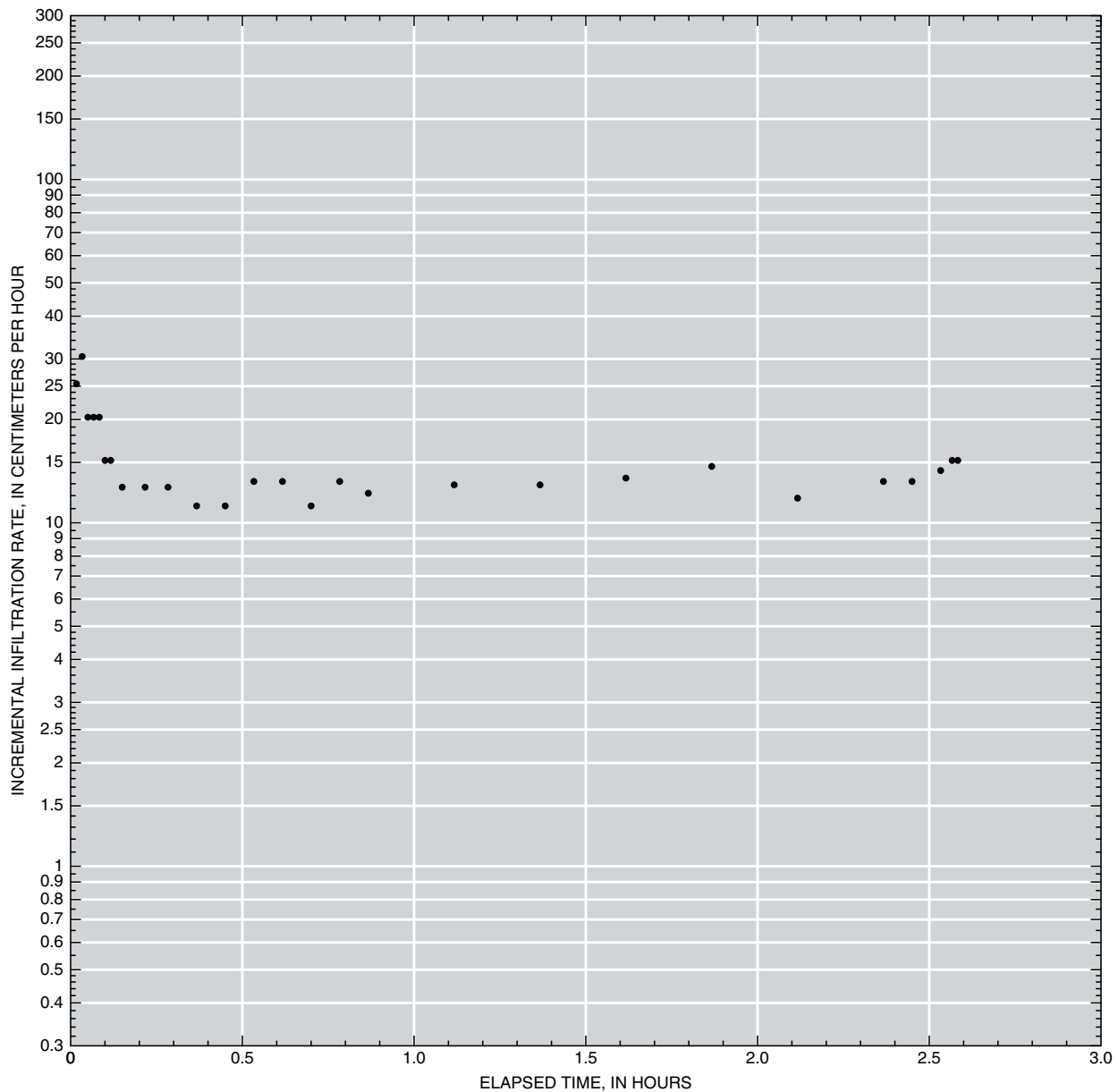
```
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)
```

Appendix 1-1.   Infiltration data for site AD1.

Incremental infiltration rate (velocity) is calculated as:

```
v = dV / (A * dt)
```

```
where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.
```

Modified from American Society for Testing and Materials (1994)

Appendix 1-2.   Infiltration data for site AD2.

```
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)
```

Appendix 1-3.   Infiltration data for site AD3.

Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-4.   Infiltration data for site ARS1.

```
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)
```

Appendix 1-5.   Infiltration data for site ARS2.

Incremental infiltration rate (velocity) is calculated as:

```
v = dV / (A * dt)
```

```
where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.
```

Modified from American Society for Testing and Materials (1994)

Appendix 1-6.   Infiltration data for site ARS3.

```
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)
```

Appendix 1-7.   Infiltration data for site BR1.

```
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)
```

Appendix 1-8. Infiltration data for site BR2.

Incremental infiltration rate (velocity) is calculated as:

$$v = dV / (A * dt)$$

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-9.   Infiltration data for site BR3.

Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-10.   Infiltration data for site AFB1.

Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-11.   Infiltration data for site AFB2.
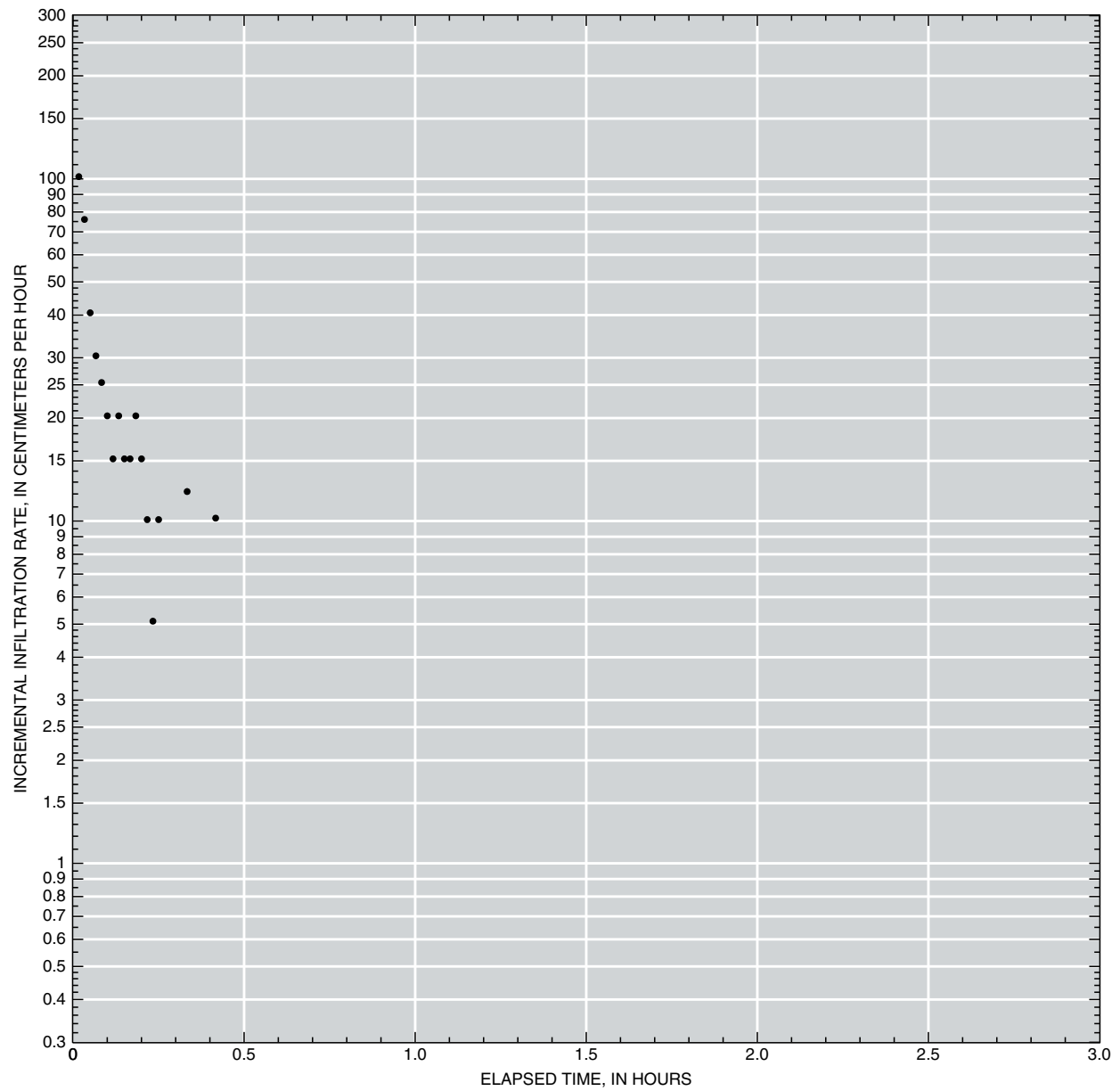
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-12.   Infiltration data for site GC1.
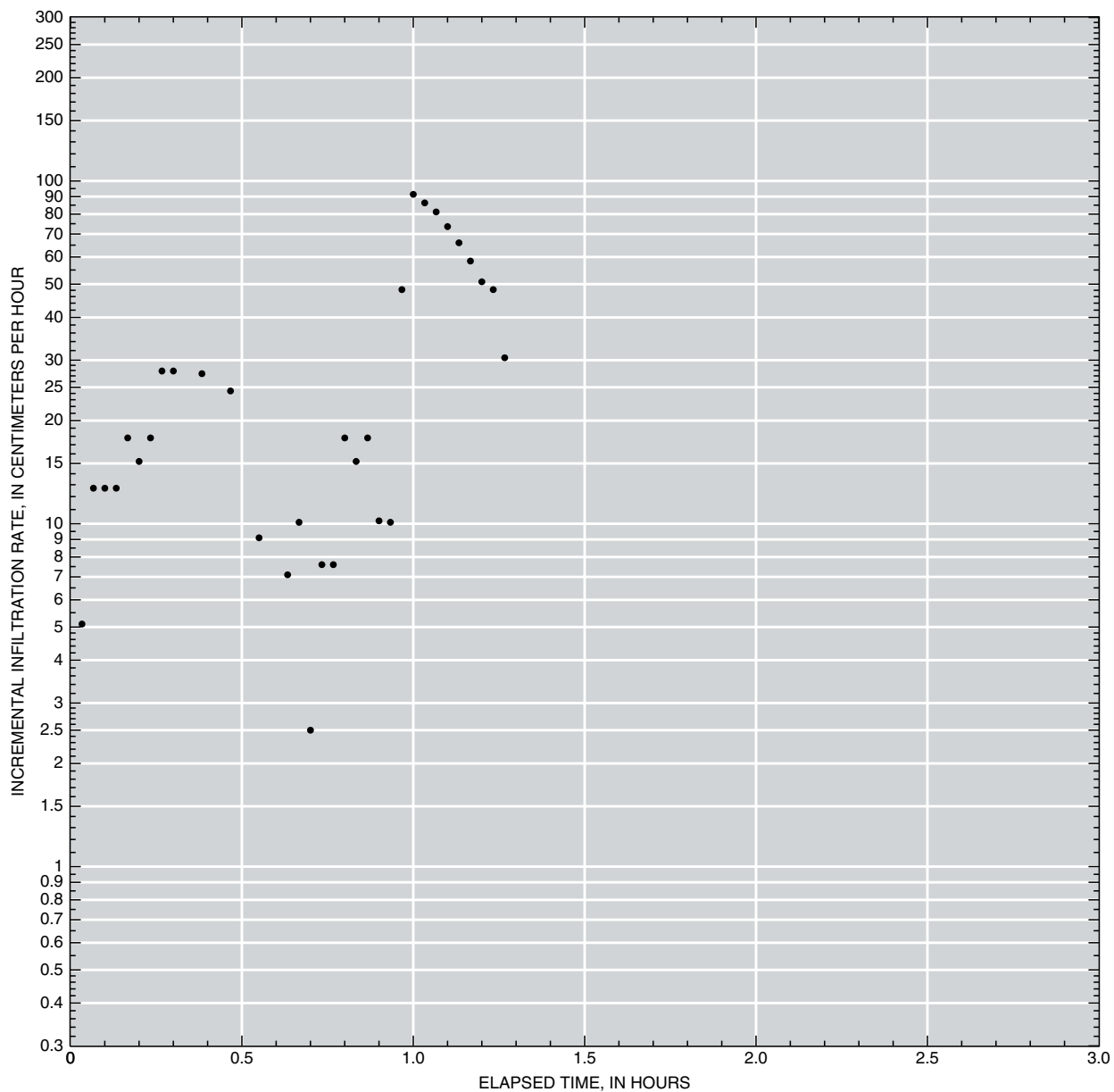
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-13.   Infiltration data for site GC2.
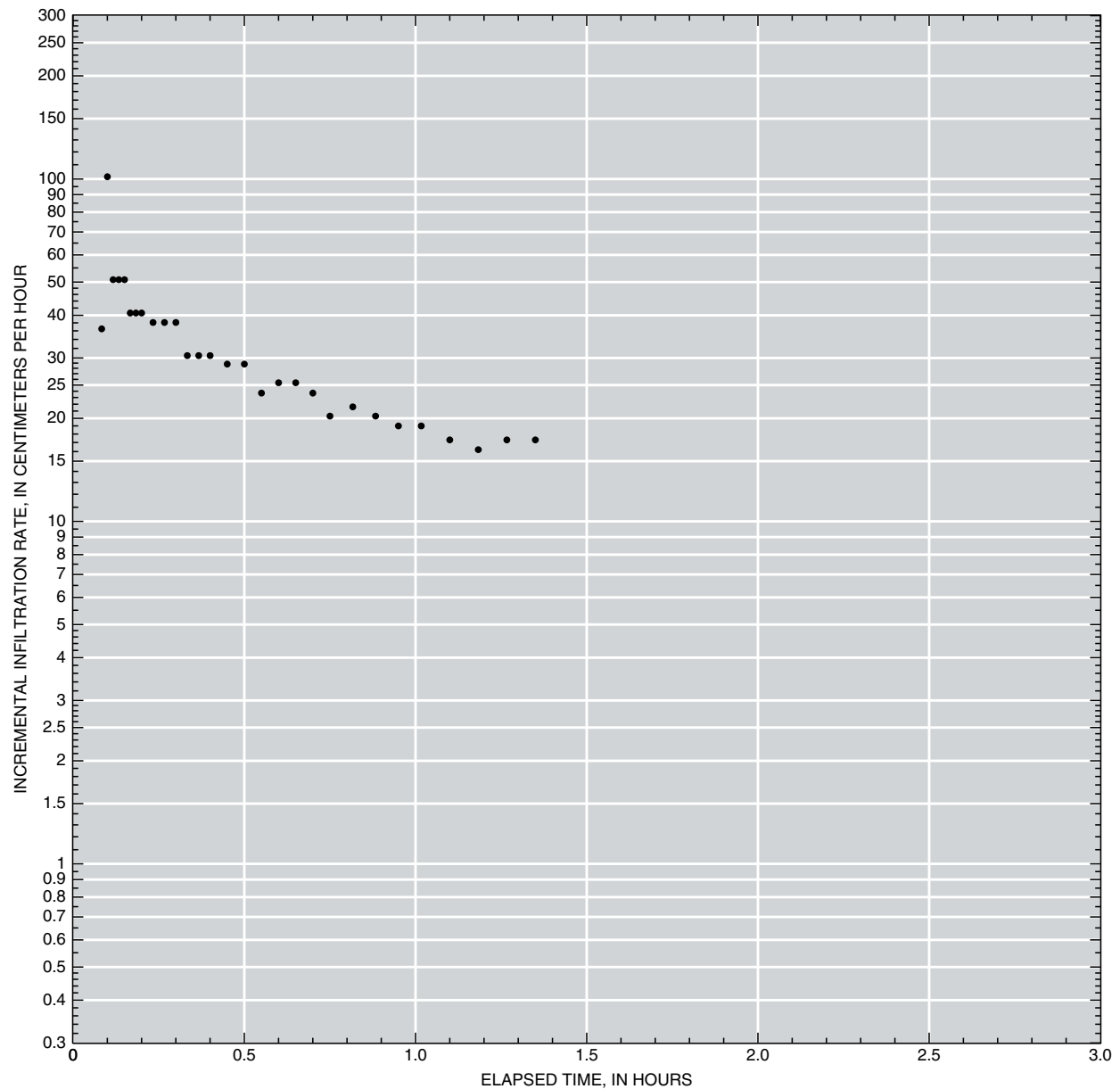
Incremental infiltration rate (velocity) is calculated as:

```
v = dV / (A * dt)
```

where:
```
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.
```

Modified from American Society for Testing and Materials (1994)

Appendix 1-14.   Infiltration data for site GC3.
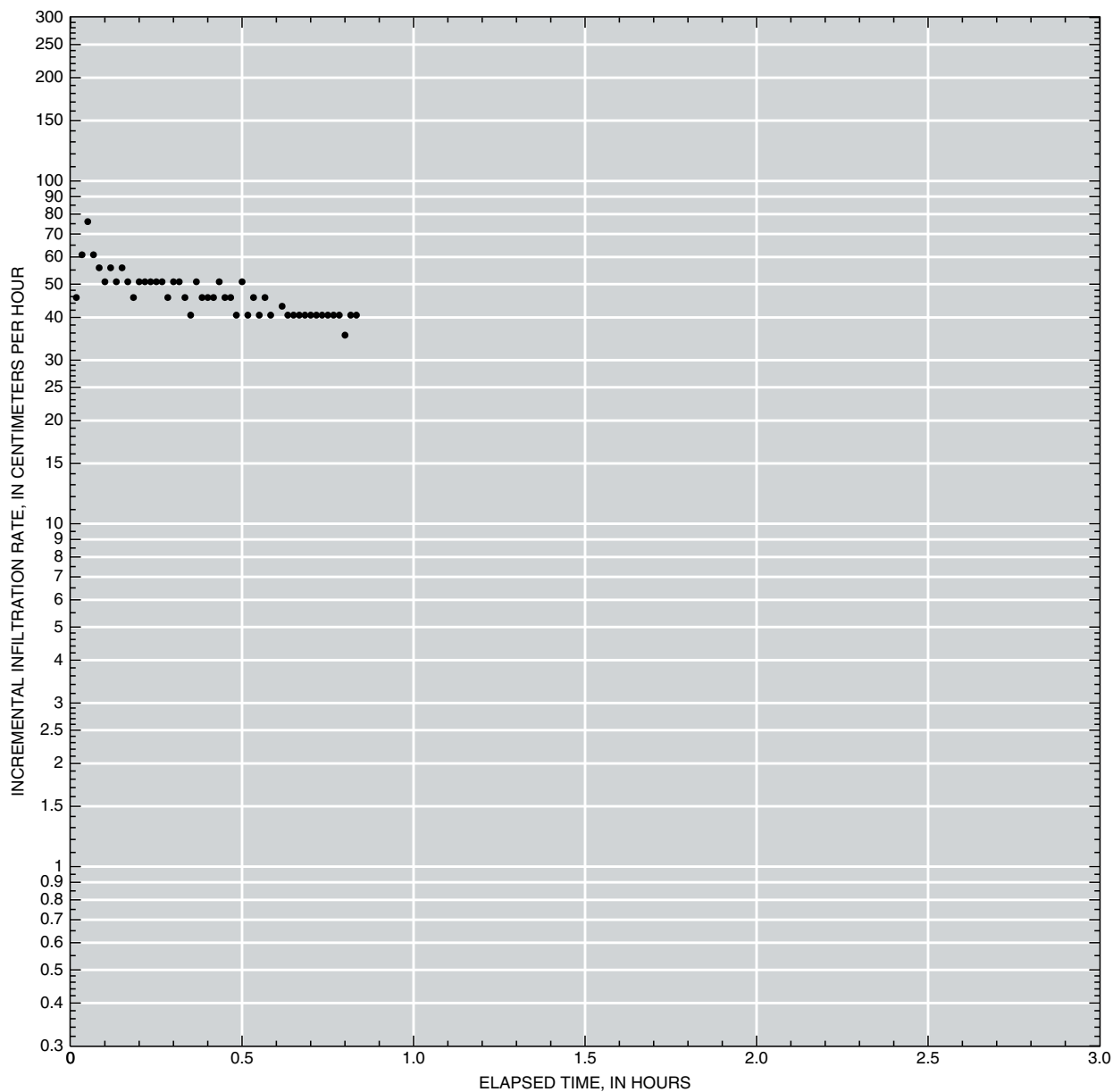
```
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)
```
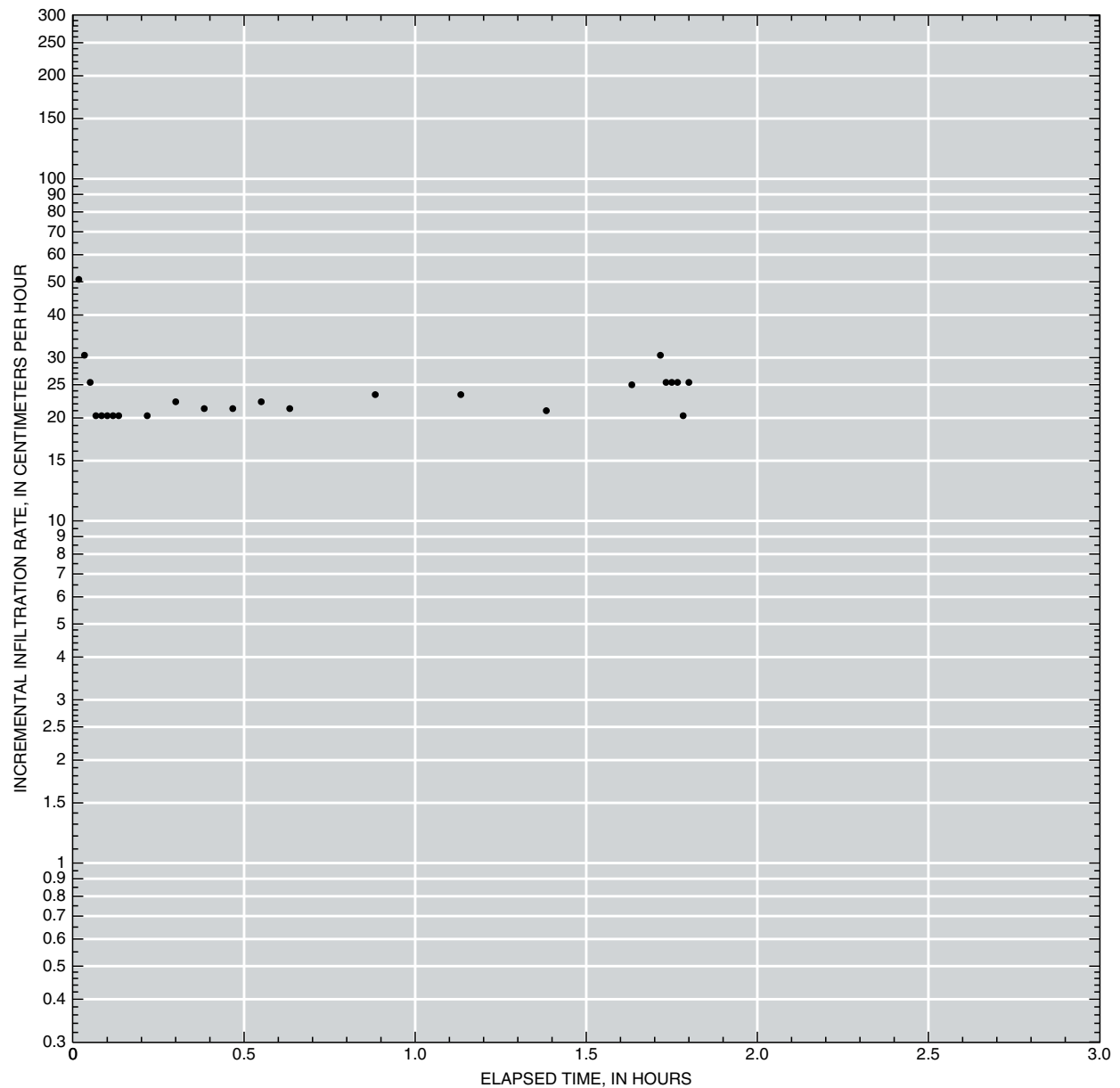
Appendix 1-15.   Infiltration data for site LG1.
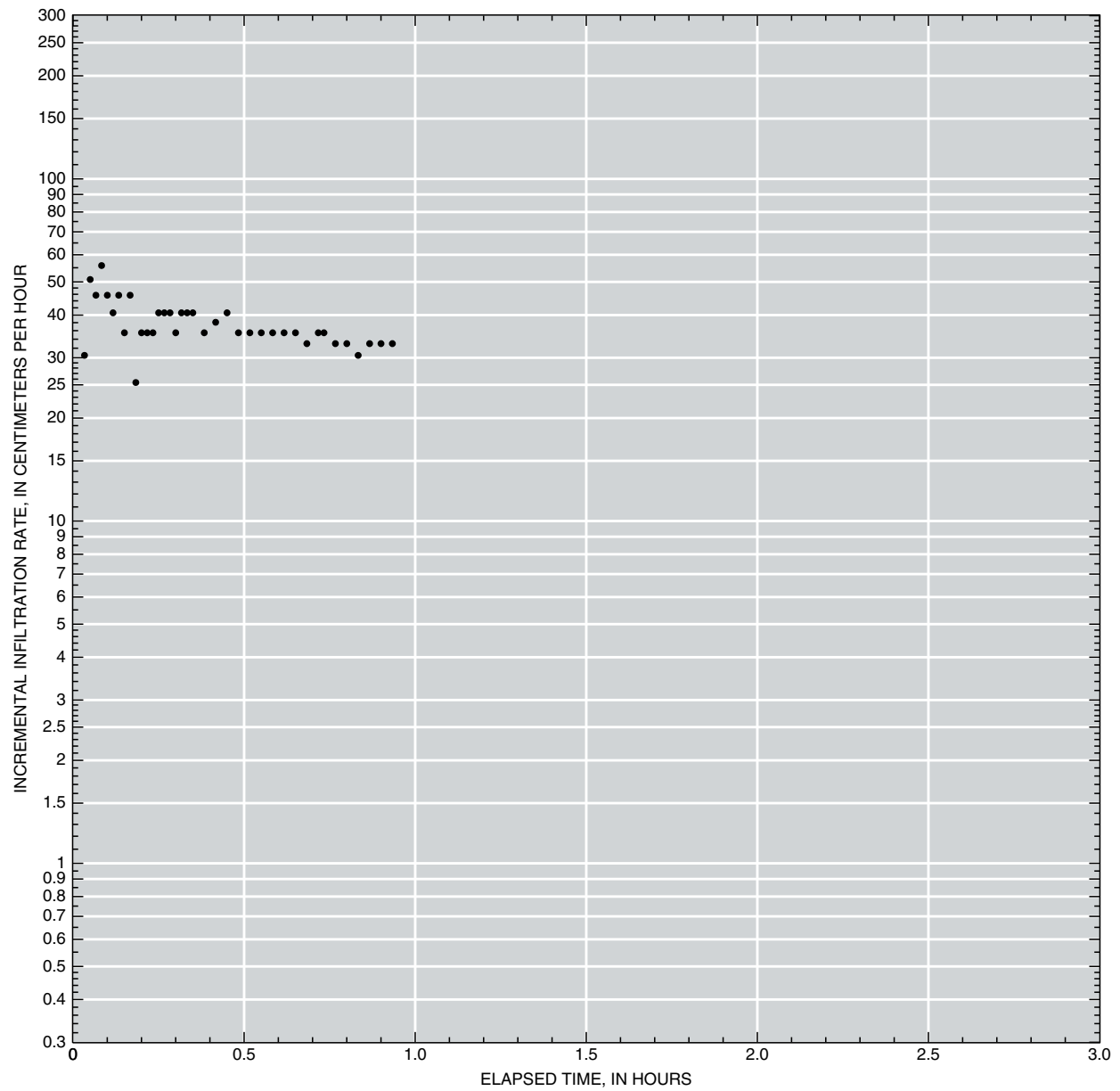
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-16.   Infiltration data for site LG2.
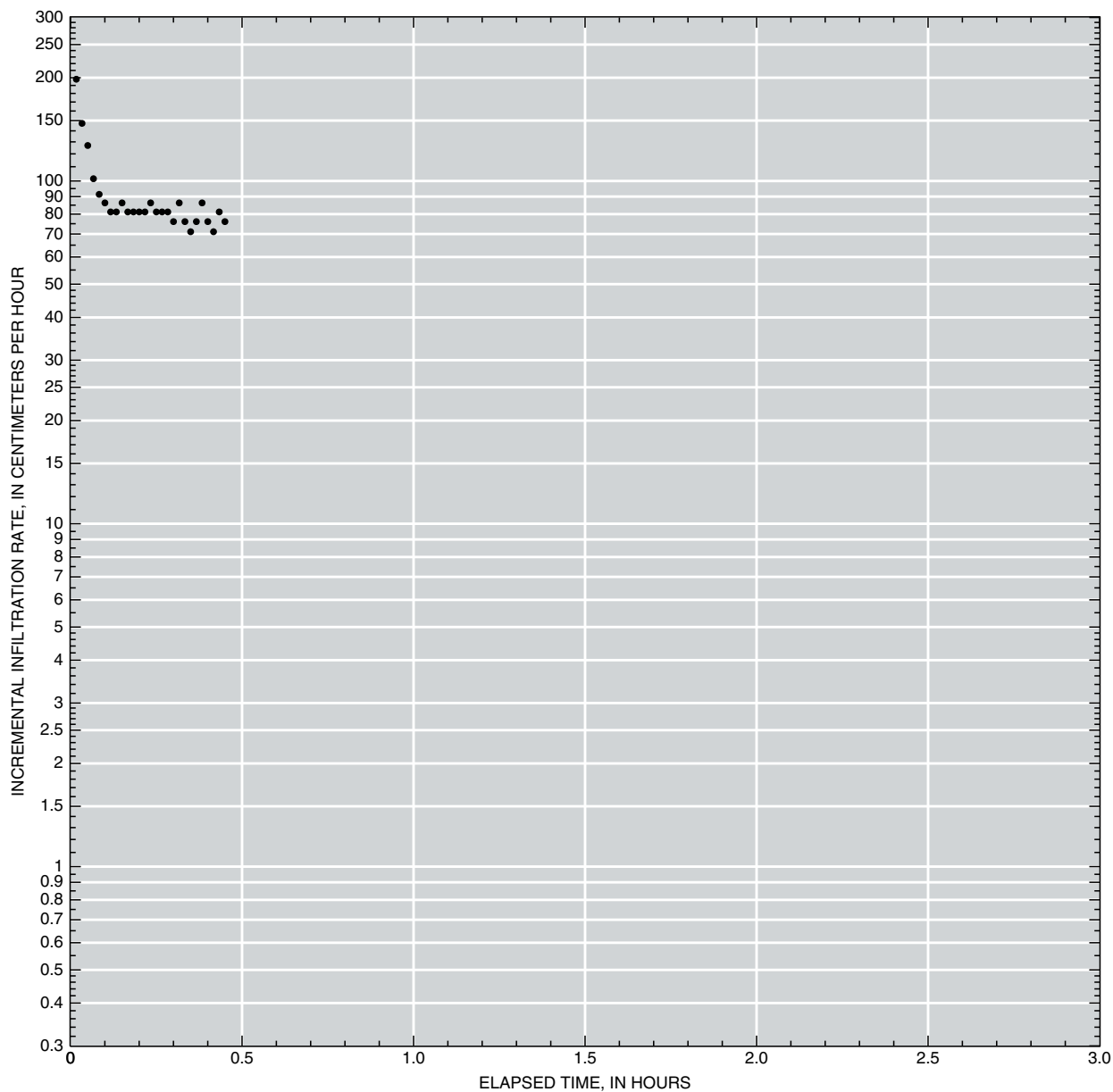
```
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)
```
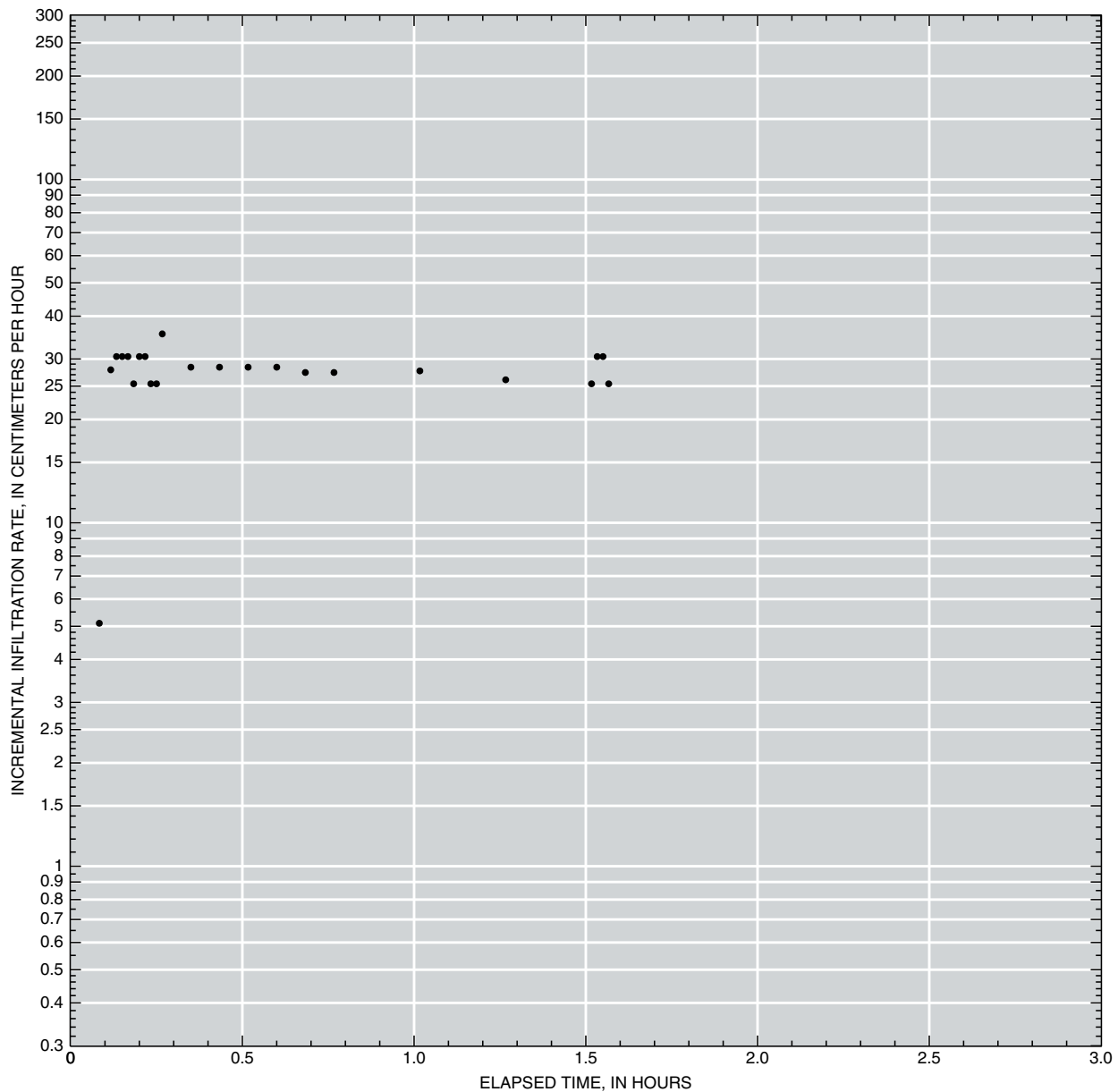
Appendix 1-17. Infiltration data for site LG3.
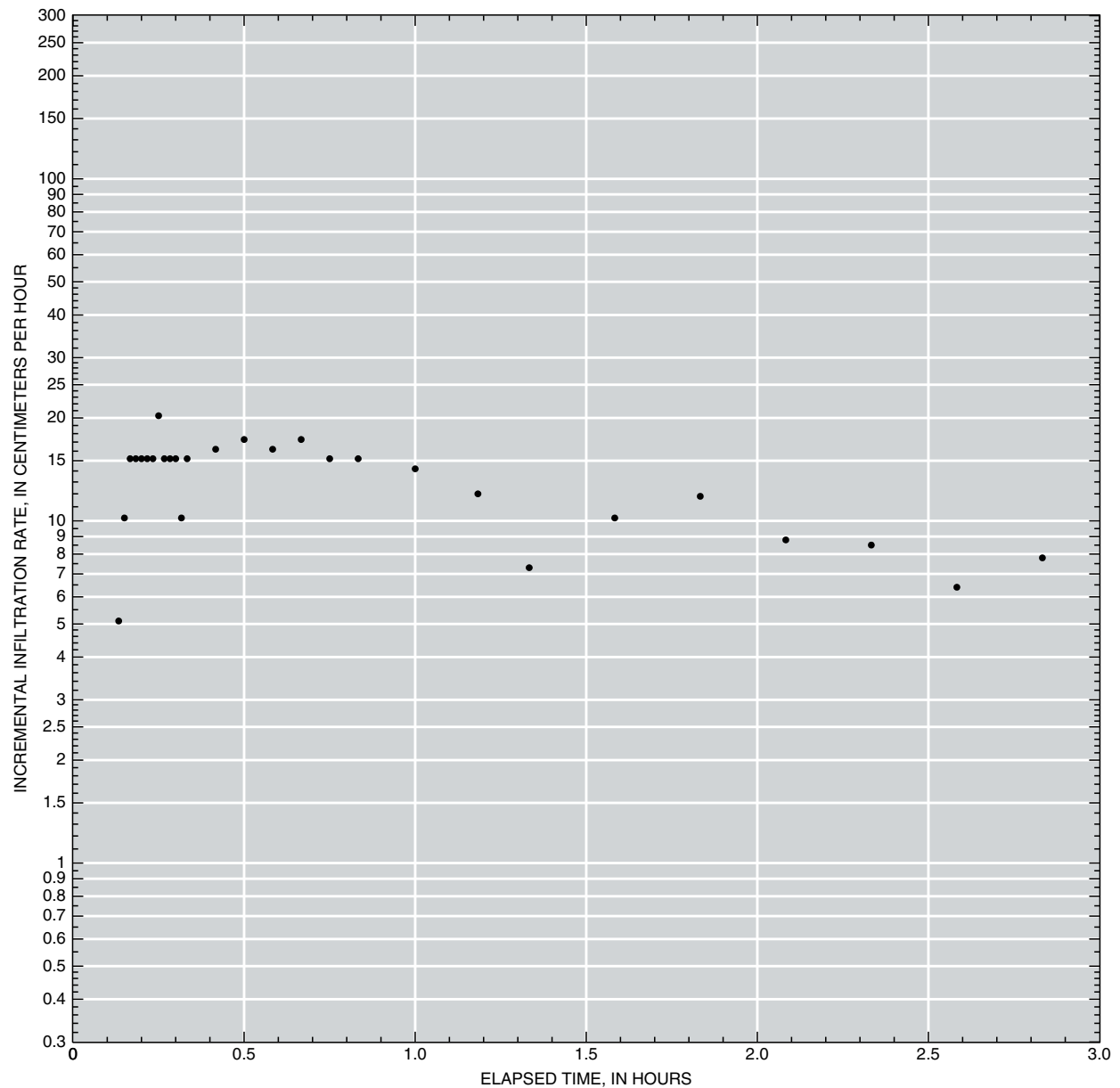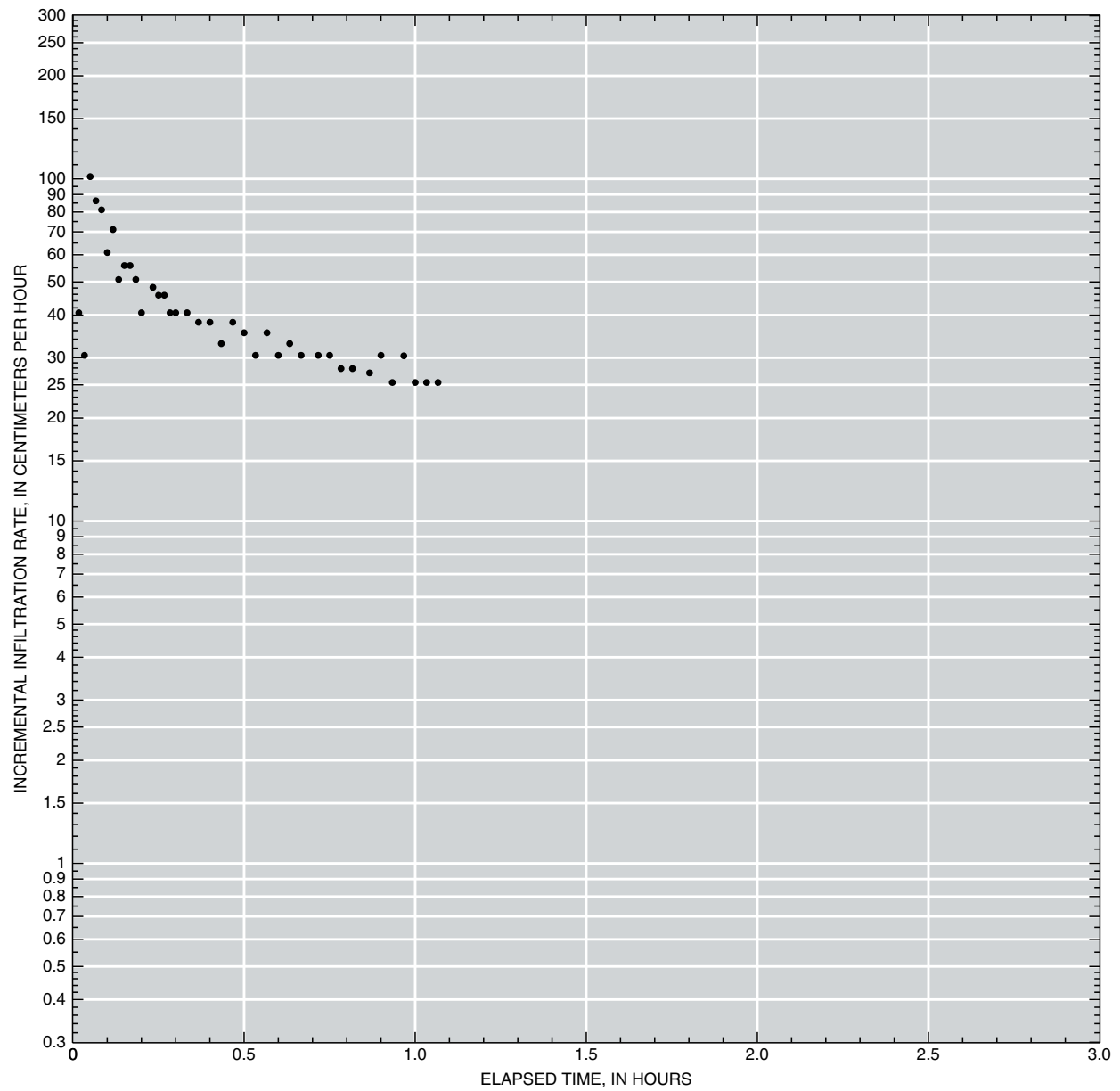
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-18. Infiltration data for site LG4.
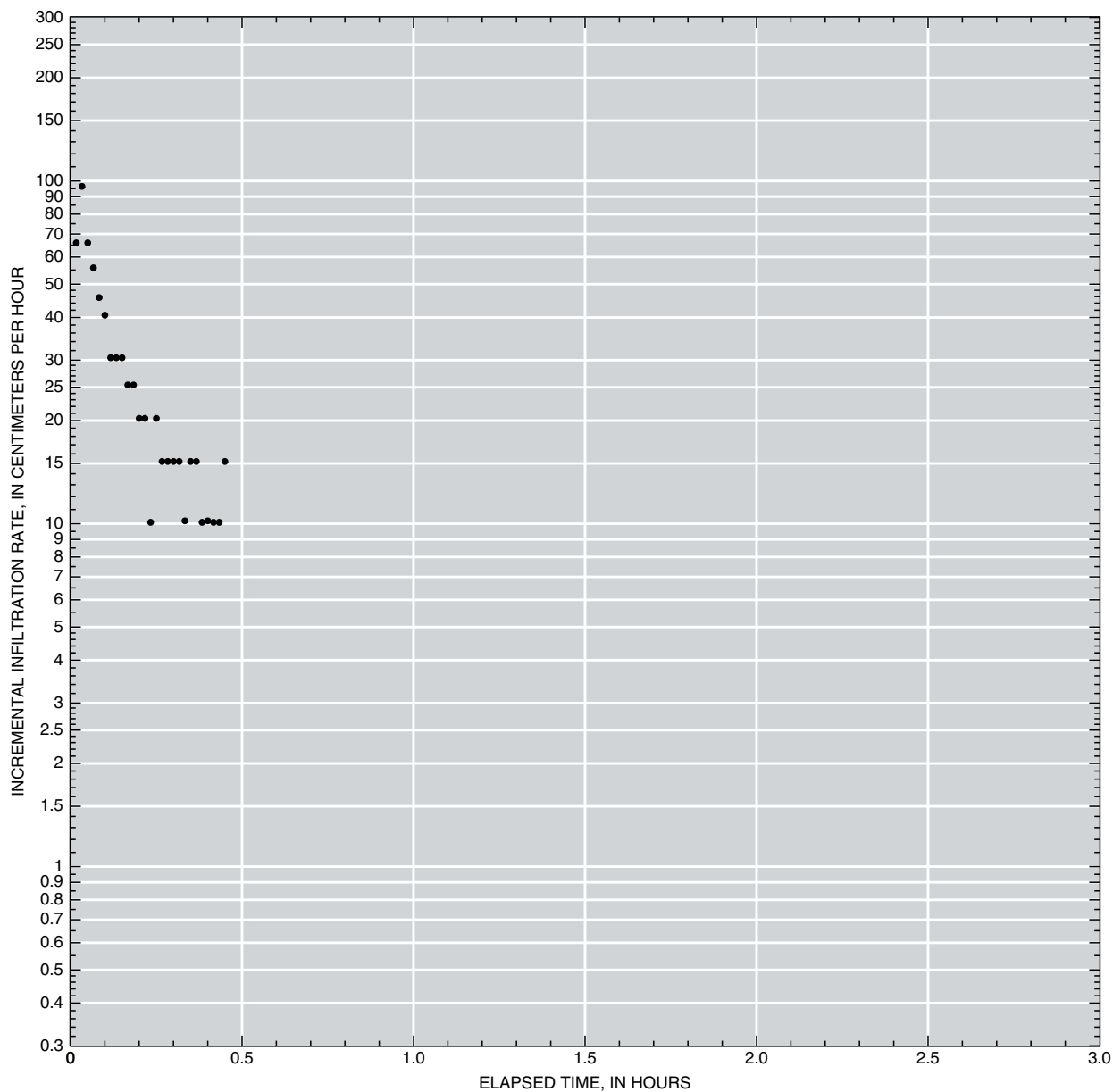
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-19.   Infiltration data for site DC1.
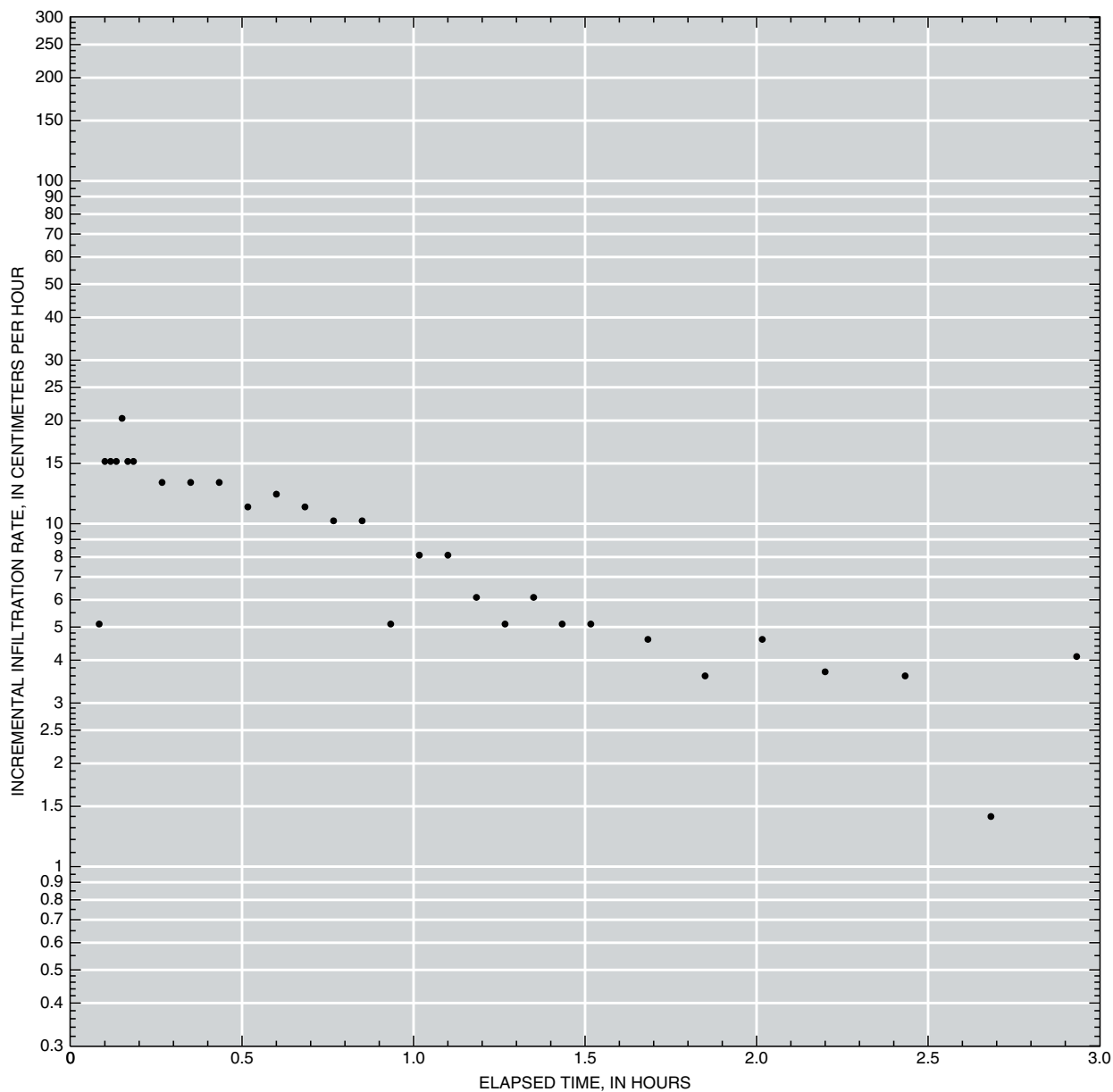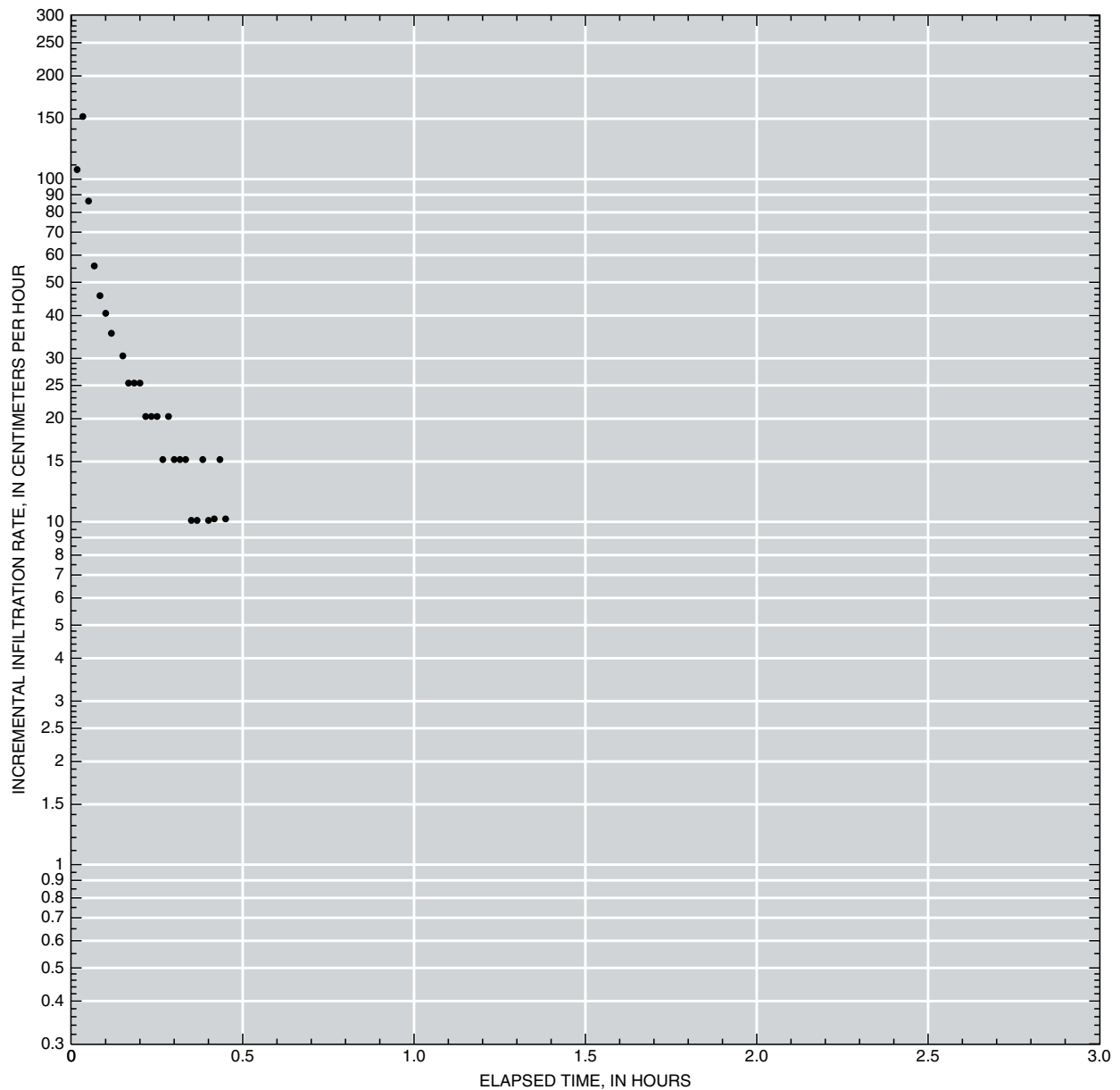
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-20. Infiltration data for site DC2.
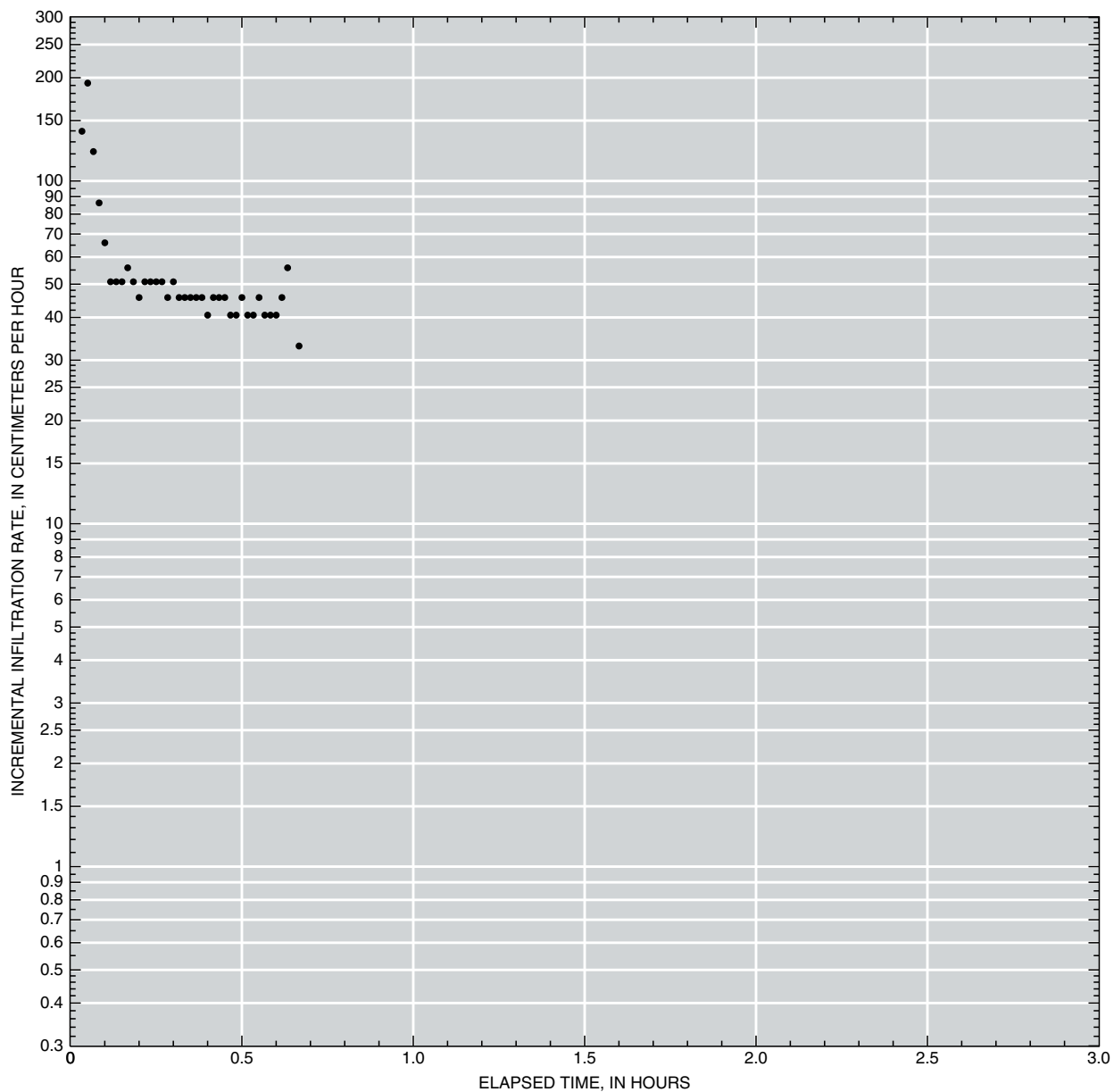
```
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v  = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A  = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)
```
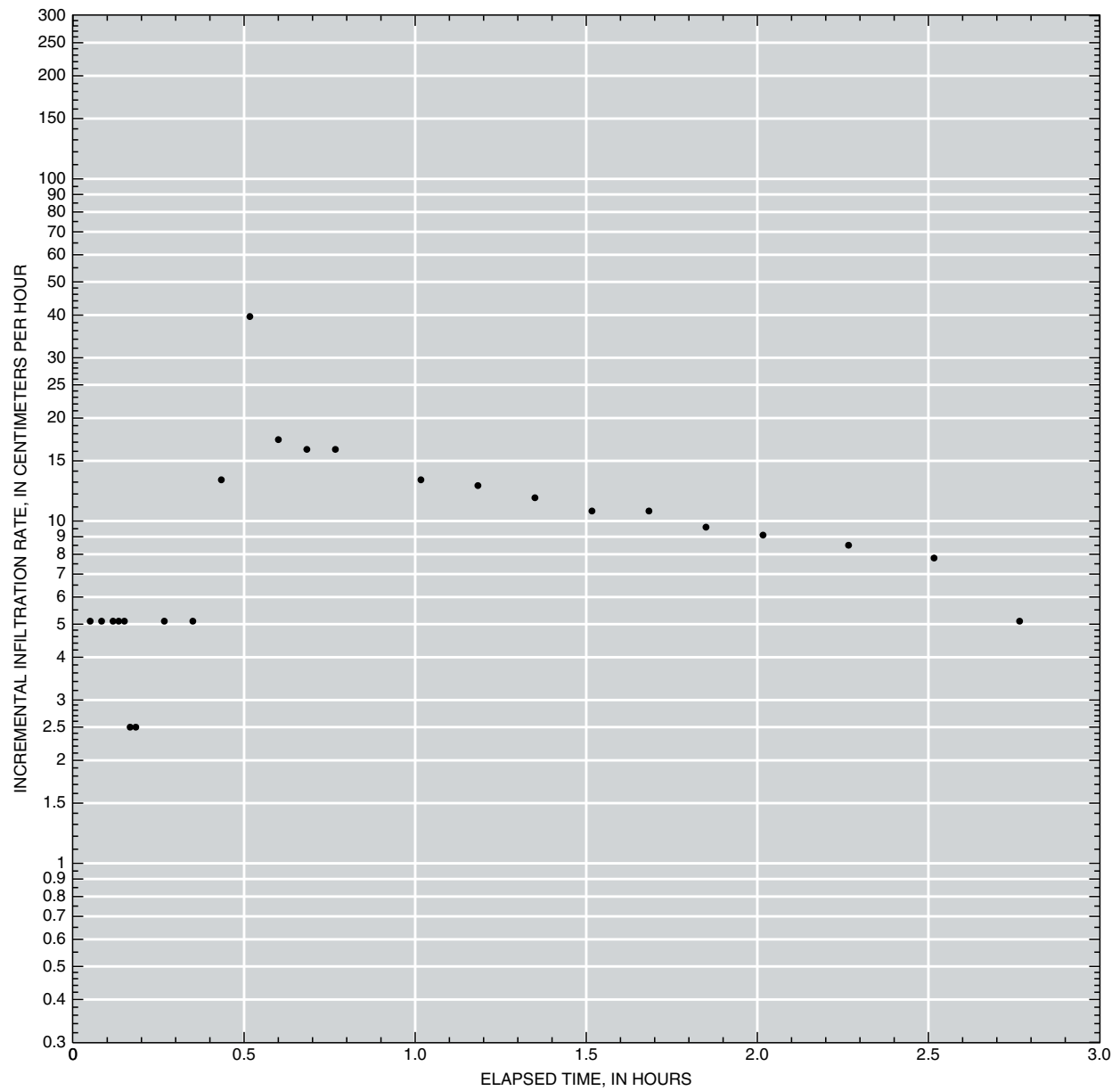
Appendix 1-21. Infiltration data for site SP1.
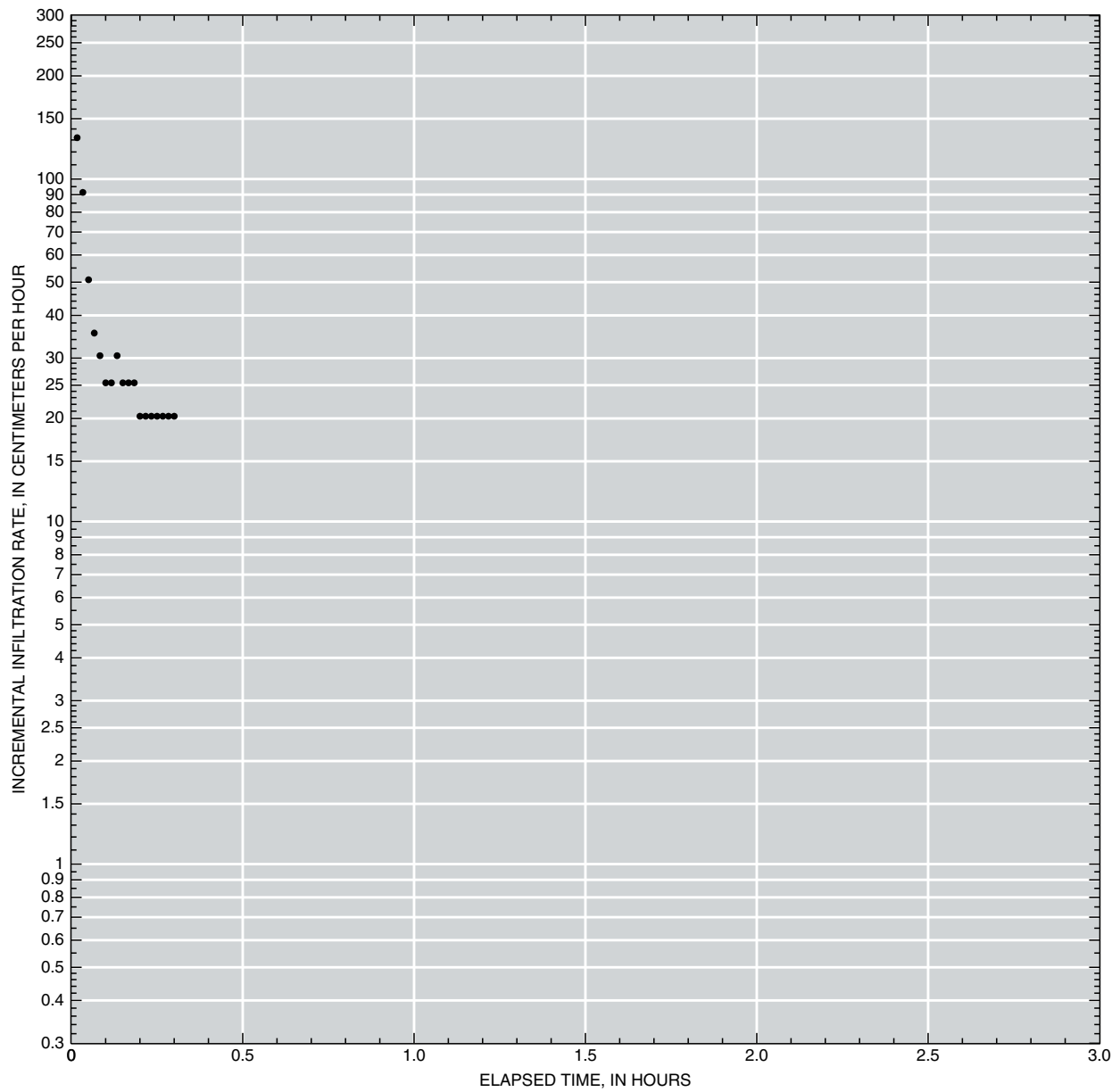
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-22.   Infiltration data for site SP2.
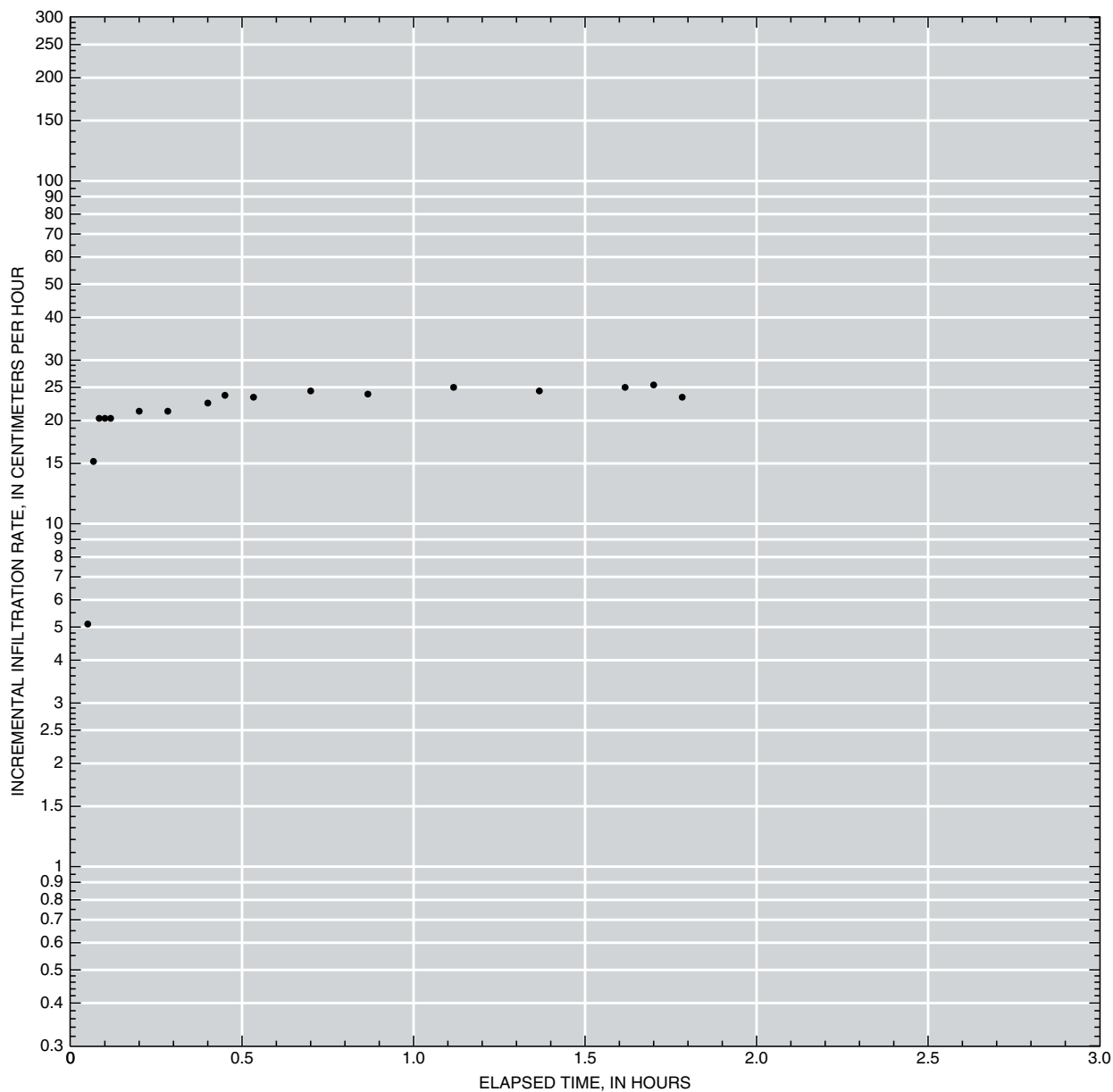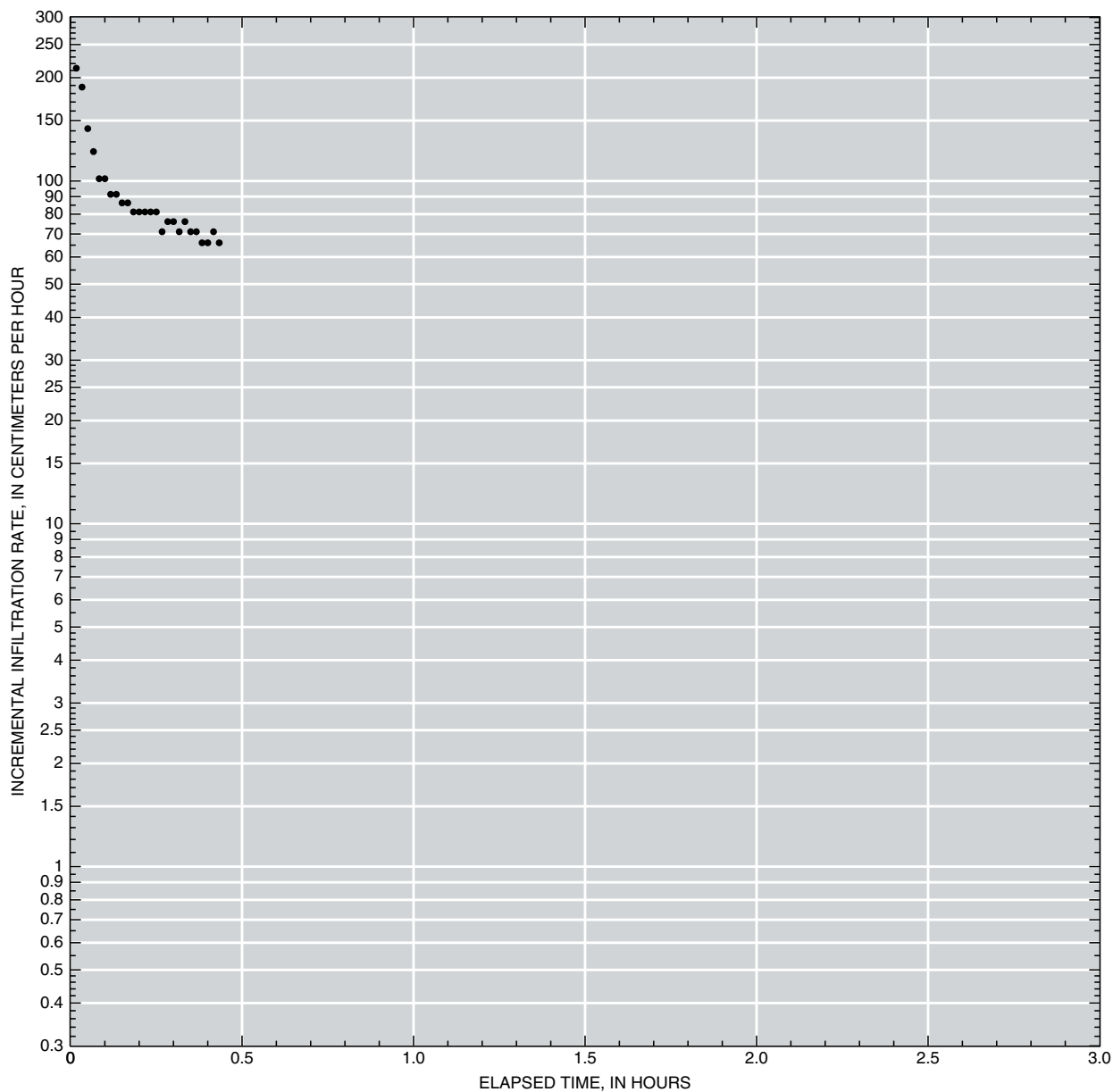
Incremental infiltration rate (velocity) is calculated as:

v = dV / (A * dt)

where:
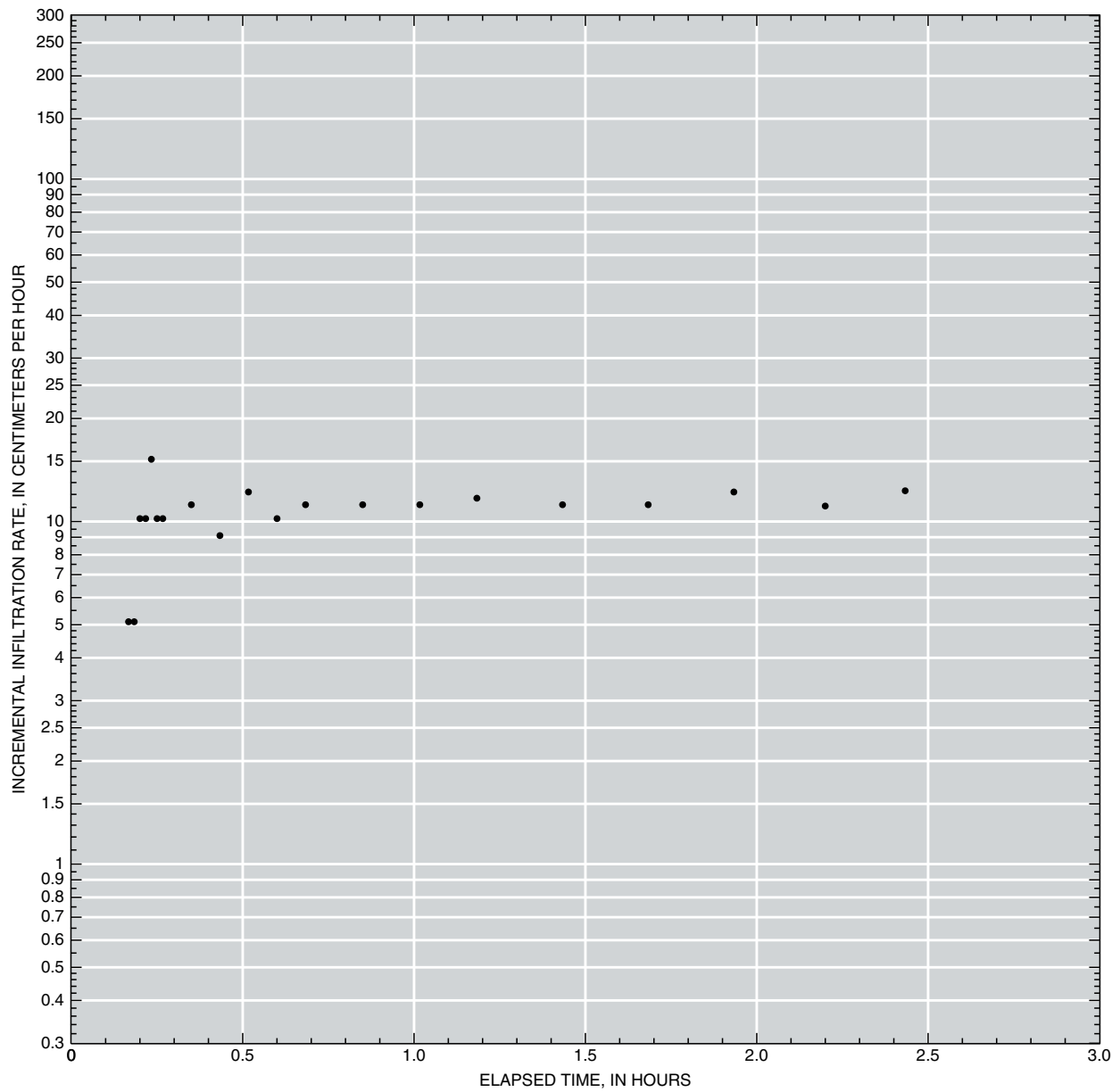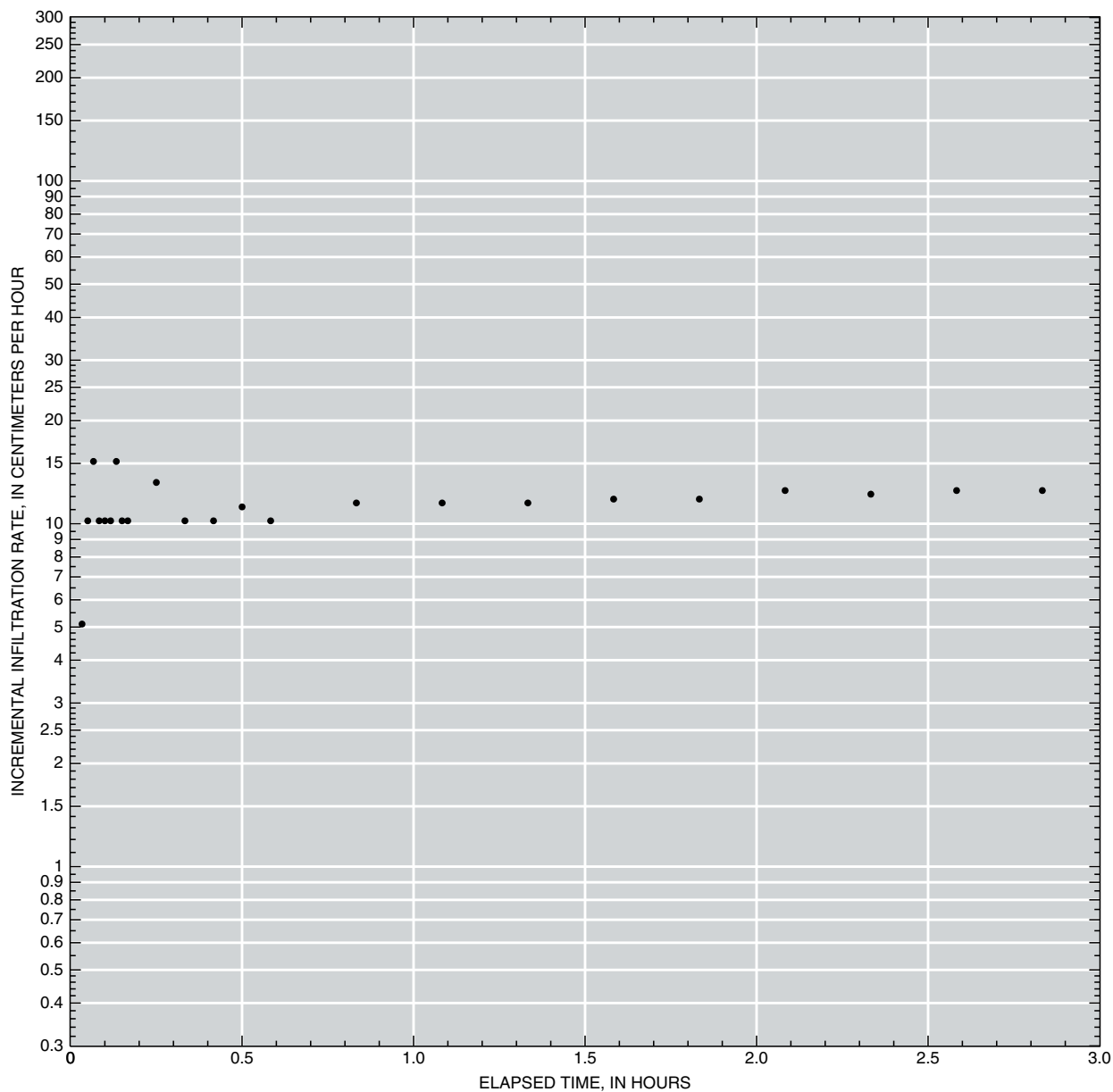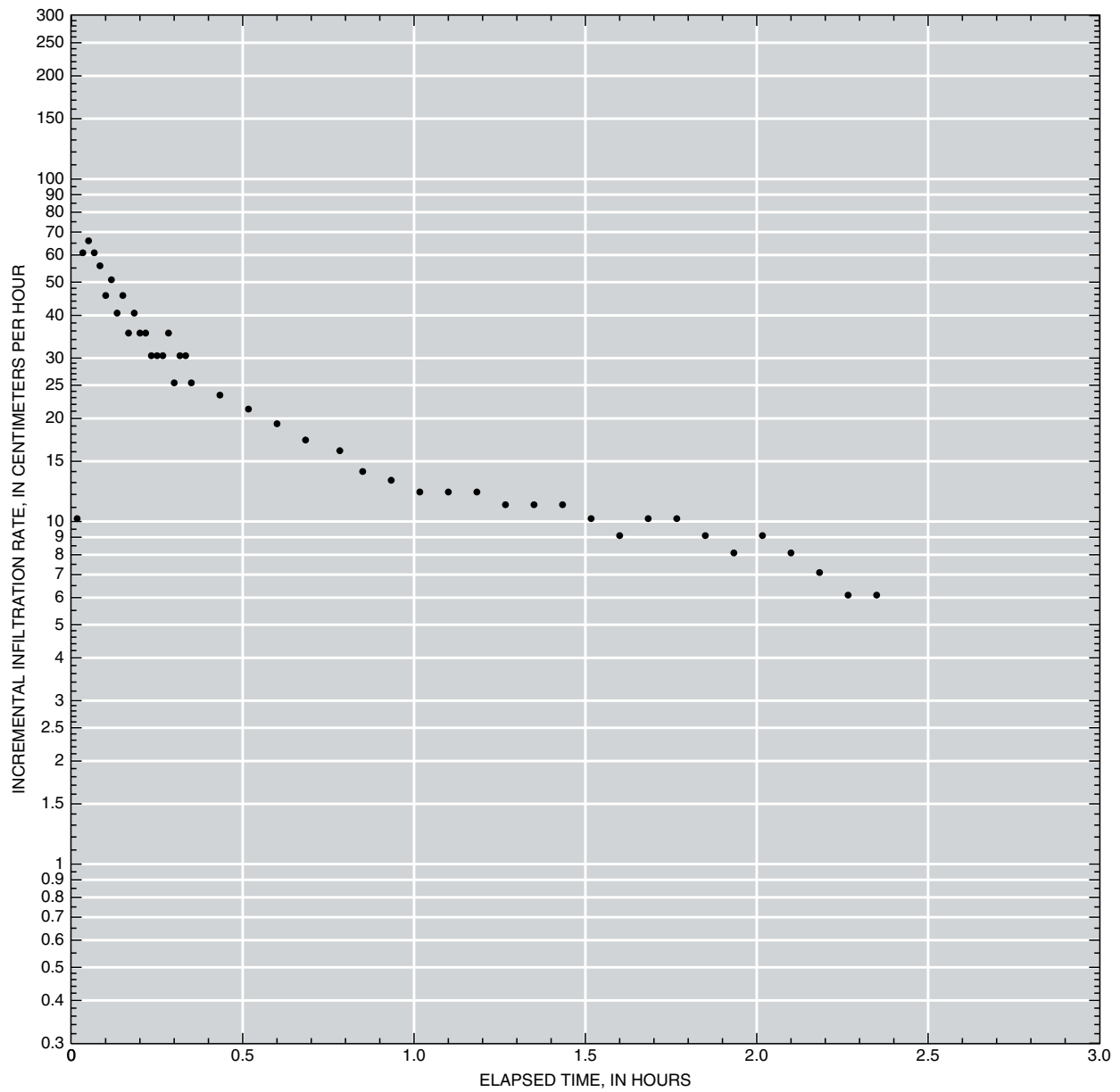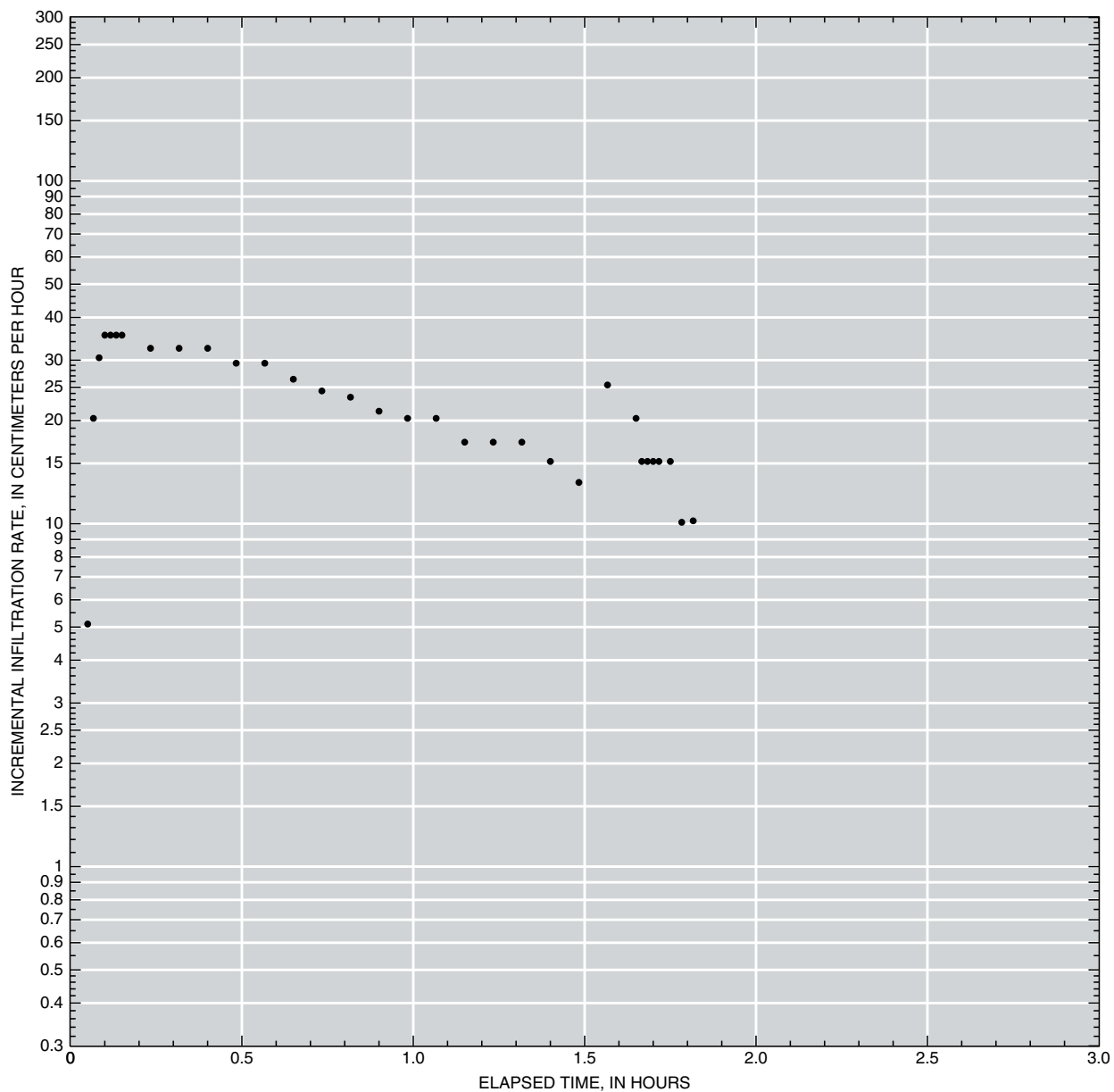v = incremental infiltration velocity, in centimeters per hour,
dV = volume of water used during time interval to maintain constant head, in milliliters,
A = area of ring infiltrometer, in square centimeters,
dt = time interval, in hours.

Modified from American Society for Testing and Materials (1994)

Appendix 1-23.   Infiltration data for site SP3.

Appendix 2.   Infiltration Data

Appendix 2-1. Infiltration data for site AD1.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

Time		Tube (units)	Time	Time		Incremental	
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
10	38	9.10	10.633	--	--	--	--
10	39	9.60	10.650	0.017	0.017	1,250	25.4
10	40	10.20	10.667	.017	.033	1,500	30.5
10	41	10.60	10.683	.017	.050	1,000	20.3
10	42	11.00	10.700	.017	.067	1,000	20.3
10	43	11.40	10.717	.017	.083	1,000	20.3
10	44	11.70	10.733	.017	.100	749	15.2
10	45	12.00	10.750	.017	.117	750	15.2
10	47	12.50	10.783	.033	.150	1,250	12.7
10	51	13.50	10.850	.067	.217	2,500	12.7
10	55	14.50	10.917	.067	.283	2,500	12.7
11	00	15.60	11.000	.083	.367	2,750	11.2
11	05	16.70	11.083	.083	.450	2,750	11.2
11	10	18.00	11.167	.083	.533	3,250	13.2
11	15	19.30	11.250	.083	.617	3,250	13.2
11	20	20.40	11.333	.083	.700	2,749	11.2
11	25	21.70	11.417	.083	.783	3,250	13.2
11	30	22.90	11.500	.083	.867	3,000	12.2
11	45	26.70	11.750	.250	1.117	9,500	12.9
12	00	30.50	12.000	.250	1.367	9,500	12.9
12	15	34.50	12.250	.250	1.617	10,000	13.5
12	30	38.80	12.500	.250	1.867	10,750	14.6
12	45	42.30	12.750	.250	2.117	8,750	11.8
13	00	46.20	13.000	.250	2.367	9,750	13.2
13	05	47.50	13.083	.083	2.450	3,249	13.2
13	10	48.90	13.167	.083	2.533	3,500	14.2
13	12	49.50	13.200	.033	2.567	1,500	15.2
13	13	49.80	13.217	.017	2.583	749	15.2

Penetration	
Ring	Depth (inches)
Inner	3.0
Outer	1.5

Water temperature	
Temperature (degrees Celsius)	Time
19.0	10:47
21.5	12:00
23.5	13:13

Constant water level	
Ring	Depth (feet)
Inner	0.30
Outer	0.35

Soil temperature	
Temperature (degrees Celsius)	Depth (inches)
22.0	5.0

Comments: No evidence of rings leaking.

Appendix 2-2.   Infiltration data for site AD2.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; nd, no data; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
8	52	--	8.867	--	--	--	--
8	53	1.00	8.883	0.017	0.017	2,500	50.8
8	54	1.60	8.900	.017	.033	1,500	30.5
8	55	2.10	8.917	.017	.050	1,250	25.4
8	56	2.50	8.933	.017	.067	1,000	20.3
8	57	2.90	8.950	.017	.083	1,000	20.3
8	58	3.30	8.967	.017	.100	1,000	20.3
8	59	3.70	8.983	.017	.117	1,000	20.3
9	00	4.10	9.000	.017	.133	999	20.3
9	05	6.10	9.083	.083	.217	5,000	20.3
9	10	8.30	9.167	.083	.300	5,500	22.3
9	15	10.40	9.250	.083	.383	5,250	21.3
9	20	12.50	9.333	.083	.467	5,250	21.3
9	25	14.70	9.417	.083	.550	5,500	22.3
9	30	16.80	9.500	.083	.633	5,250	21.3
9	45	23.70	9.750	.250	.883	17,250	23.4
10	00	30.60	10.000	.250	1.133	17,250	23.4
10	15	36.80	10.250	.250	1.383	15,500	21.0
10	30	44.20	10.500	.250	1.633	18,500	25.0
10	35	47.20	10.583	.083	1.717	7,500	30.5
10	36	47.70	10.600	.017	1.733	1,250	25.4
10	37	48.20	10.617	.017	1.750	1,250	25.4
10	38	48.70	10.633	.017	1.767	1,250	25.4
10	39	49.10	10.650	.017	1.783	999	20.3
10	40	49.60	10.667	.017	1.800	1,250	25.4

| Penetration | |
Ring	Depth (inches)
Inner	3.5
Outer	3.0

| Constant water level | |
Ring	Depth (inches)
Inner	3.0
Outer	3.0

| Water temperature | |
Temperature (degrees Celsius)	Time
16.0	09:05
16.5	09:25
18.0	10:40

| Soil temperature | |
Temperature (degrees Celsius)	Depth (inches)
19.0	5.8

Comments: No evidence of rings leaking.

Appendix 2-3.   Infiltration data for site AD3.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
11	29	0.10	11.483	--	--	--	--
11	34	0.60	11.567	0.083	0.083	1,250	5.1
11	36	1.70	11.600	.033	.117	2,750	27.9
11	37	2.30	11.617	.017	.133	1,500	30.5
11	38	2.90	11.633	.017	.150	1,500	30.5
11	39	3.50	11.650	.017	.167	1,500	30.5
11	40	4.00	11.667	.017	.183	1,250	25.4
11	41	4.60	11.683	.017	.200	1,500	30.5
11	42	5.20	11.700	.017	.217	1,500	30.5
11	43	5.70	11.717	.017	.233	1,250	25.4
11	44	6.20	11.733	.017	.250	1,250	25.4
11	45	6.90	11.750	.017	.267	1,750	35.5
11	50	9.70	11.833	.083	.350	7,000	28.4
11	55	12.50	11.917	.083	.433	7,000	28.4
12		15.30	12.000	.083	.517	7,000	28.4
12	5	18.10	12.083	.083	.600	7,000	28.4
12	10	20.80	12.167	.083	.683	6,750	27.4
12	15	23.50	12.250	.083	.767	6,750	27.4
12	30	31.70	12.500	.250	1.017	20,500	27.7
12	45	39.40	12.750	.250	1.267	19,250	26.1
13		46.90	13.000	.250	1.517	18,750	25.4
13	1	47.50	13.017	.017	1.533	1,500	30.5
13	2	48.10	13.033	.017	1.550	1,500	30.5
13	3	48.60	13.050	.017	1.567	1,250	25.4

| Penetration | |
Ring	Depth (inches)
Inner	4.0
Outer	4.0

| Constant water level | |
Ring	Depth (inches)
Inner	2.25
Outer	2.25

| Water temperature | |
Temperature (degrees Celsius)	Time
19.0	11:38
20.5	12:05
22.0	13:04

| Soil temperature | |
Temperature (degrees Celsius)	Depth (inches)
22.0	5.0

Comments: No evidence of rings leaking.

Appendix 2-4.   Infiltration data for site ARS1.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

Time		Tube (units)	Time	Time		Incremental	
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
8	40	0.30	8.667	--	--	--	--
8	42	0.30	8.700	0.033	0.033	--	--
8	44	0.30	8.733	.033	.067	--	--
8	46	0.30	8.767	.033	.100	--	--
8	48	0.50	8.800	.033	.133	500	5.1
8	49	0.70	8.817	.017	.150	500	10.2
8	50	1.00	8.833	.017	.167	750	15.2
8	51	1.30	8.850	.017	.183	750	15.2
8	52	1.60	8.867	.017	.200	750	15.2
8	53	1.90	8.883	.017	.217	750	15.2
8	54	2.20	8.900	.017	.233	750	15.2
8	55	2.60	8.917	.017	.250	1,000	20.3
8	56	2.90	8.933	.017	.267	750	15.2
8	57	3.20	8.950	.017	.283	750	15.2
8	58	3.50	8.967	.017	.300	750	15.2
8	59	3.70	8.983	.017	.317	500	10.2
9	00	4.00	9.000	.017	.333	750	15.2
9	05	5.60	9.083	.083	.417	4,000	16.2
9	10	7.30	9.167	.083	.500	4,250	17.3
9	15	8.90	9.250	.083	.583	4,000	16.2
9	20	10.60	9.333	.083	.667	4,250	17.3
9	25	12.10	9.417	.083	.750	3,750	15.2
9	30	13.60	9.500	.083	.833	3,750	15.2
9	40	16.40	9.667	.167	1.000	7,000	14.2
9	51	19.00	9.850	.183	1.183	6,500	12.0
10	00	20.30	10.000	.150	1.333	3,250	7.3
10	15	23.30	10.250	.250	1.583	7,500	10.2
10	30	26.80	10.500	.250	1.833	8,750	11.8
10	45	29.40	10.750	.250	2.083	6,499	8.8
11	00	31.90	11.000	.250	2.333	6,250	8.5
11	15	33.80	11.250	.250	2.583	4,750	6.4
11	30	36.10	11.500	.250	2.833	5,750	7.8
11	45	38.40	11.750	.250	3.083	5,749	7.8
12	00	40.40	12.000	.250	3.333	5,000	6.8
12	15	41.70	12.250	.250	3.583	3,250	4.4
12	30	44.20	12.500	.250	3.833	6,250	8.5
12	45	46.40	12.750	.250	4.083	5,499	7.4
13	00	48.50	13.000	.250	4.333	5,250	7.1

Appendix 2-4.   Infiltration data for site ARS1.—Continued

Penetration	
Ring	**Depth (inches)**
Inner	4.5
Outer	2.5

Constant water level	
Ring	**Depth (inches)**
Inner	2.25
Outer	2.25

Water temperature	
Temperature (degrees Celsius)	**Time**
18.0	08:46
23.0	11:15
27.0	13:00

Soil temperature	
Temperature (degrees Celsius)	**Depth (inches)**
19.0	4.5

Comments: Inner ring initial fill depth 3 inches.

Appendix 2-5.   Infiltration data for site ARS2.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
13	34	0.60	13.567	--	--	--	--
13	35	0.60	13.583	0.017	0.017	--	--
13	36	0.60	13.600	.017	.033	--	--
13	37	0.60	13.617	.017	.050	--	--
13	38	0.60	13.633	.017	.067	--	--
13	39	0.70	13.650	.017	.083	250	5.1
13	40	1.00	13.667	.017	.100	750	15.2
13	41	1.30	13.683	.017	.117	750	15.2
13	42	1.60	13.700	.017	.133	750	15.2
13	43	2.00	13.717	.017	.150	1,000	20.3
13	44	2.30	13.733	.017	.167	750	15.2
13	45	2.60	13.750	.017	.183	750	15.2
13	50	3.90	13.833	.083	.267	3,250	13.2
13	55	5.20	13.917	.083	.350	3,250	13.2
14	00	6.50	14.000	.083	.433	3,250	13.2
14	05	7.60	14.083	.083	.517	2,750	11.2
14	10	8.80	14.167	.083	.600	3,000	12.2
14	15	9.90	14.250	.083	.683	2,750	11.2
14	20	10.90	14.333	.083	.767	2,500	10.2
14	25	11.90	14.417	.083	.850	2,500	10.2
14	30	12.40	14.500	.083	.933	1,250	5.1
14	35	13.20	14.583	.083	1.017	2,000	8.1
14	40	14.00	14.667	.083	1.100	2,000	8.1
14	45	14.60	14.750	.083	1.183	1,500	6.1
14	50	15.10	14.833	.083	1.267	1,250	5.1
14	55	15.70	14.917	.083	1.350	1,500	6.1
15	00	16.20	15.000	.083	1.433	1,250	5.1
15	5	16.70	15.083	.083	1.517	1,250	5.1
15	15	17.60	15.250	.167	1.683	2,250	4.6
15	25	18.30	15.417	.167	1.850	1,750	3.6
15	35	19.20	15.583	.167	2.017	2,250	4.6
15	46	20.00	15.767	.183	2.200	2,000	3.7
16	00	21.00	16.000	.233	2.433	2,500	3.6
16	15	21.40	16.250	.250	2.683	999	1.4
16	30	22.60	16.500	.250	2.933	3,000	4.1
16	45	23.60	16.750	.250	3.183	2,500	3.4
17	00	24.60	17.000	.250	3.433	2,500	3.4
17	15	25.60	17.250	.250	3.683	2,500	3.4

Appendix 2-5.   Infiltration data for site ARS2.—Continued

Penetration	
Ring	**Depth (inches)**
Inner	4.5
Outer	2.5

Constant water level	
Ring	**Depth (inches)**
Inner	2.25
Outer	2.25

Water temperature	
Temperature (degrees Celsius)	**Time**
24.5	13:50
28.5	15:25
26.5	17:15

Soil temperature	
Temperature (degrees Celsius)	**Depth (inches)**
24.0	4.5

Comments: Inner ring initial fill depth 3 inches.

Appendix 2-6.   Infiltration data for site ARS3.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
8	29	--	8.483	--	--	--	--
8	30	--	8.500	0.017	0.017	--	--
8	31	--	8.517	.017	.033	--	--
8	32	0.10	8.533	.017	.050	250	5.1
8	33	.10	8.550	.017	.067	--	0.0
8	34	.20	8.567	.017	.083	250	5.1
8	35	.20	8.583	.017	.100	--	--
8	36	.30	8.600	.017	.117	250	5.1
8	37	.40	8.617	.017	.133	250	5.1
8	38	.50	8.633	.017	.150	250	5.1
8	39	.55	8.650	.017	.167	125	2.5
8	40	.60	8.667	.017	.183	125	2.5
8	45	1.10	8.750	.083	.267	1,250	5.1
8	50	1.60	8.833	.083	.350	1,250	5.1
8	55	2.90	8.917	.083	.433	3,250	13.2
9	00	6.80	9.000	.083	.517	9,750	39.6
9	05	8.50	9.083	.083	.600	4,250	17.3
9	10	10.10	9.167	.083	.683	4,000	16.2
9	15	11.70	9.250	.083	.767	4,000	16.2
9	30	15.60	9.500	.250	1.017	9,750	13.2
9	40	18.10	9.667	.167	1.183	6,250	12.7
9	50	20.40	9.833	.167	1.350	5,749	11.7
10	00	22.50	10.000	.167	1.517	5,250	10.7
10	10	24.60	10.167	.167	1.683	5,250	10.7
10	20	26.50	10.333	.167	1.850	4,750	9.6
10	30	28.30	10.500	.167	2.017	4,500	9.1
10	45	30.80	10.750	.250	2.267	6,250	8.5
11	00	33.10	11.000	.250	2.517	5,750	7.8
11	15	34.60	11.250	.250	2.767	3,750	5.1
11	30	38.50	11.500	.250	3.017	9,750	13.2
11	45	40.40	11.750	.250	3.267	4,750	6.4
12	00	42.80	12.000	.250	3.517	6,000	8.1
12	15	44.90	12.250	.250	3.767	5,250	7.1
12	20	45.70	12.333	.083	3.850	2,000	8.1
12	25	46.30	12.417	.083	3.933	1,499	6.1
12	26	46.40	12.433	.017	3.950	250	5.1
12	28	46.70	12.467	.033	3.983	750	7.6
12	30	47.00	12.500	.033	4.017	749	7.6
12	32	47.30	12.533	.033	4.050	749	7.6

Appendix 2-6. Infiltration data for site ARS3.—Continued

Penetration	
Ring	**Depth (inches)**
Inner	4.0
Outer	3.0

Constant water level	
Ring	**Depth (inches)**
Inner	2.25
Outer	2.25

Water temperature	
Temperature (degrees Celsius)	**Time**
18.0	08:55
21.0	11:00
24.0	12:32

Soil temperature	
Temperature (degrees Celsius)	**Depth (inches)**
19.5	4.5

Comments: Inner ring initial fill depth 3 inches. Flow interrupted 11:00–11:15.

Appendix 2-7.   Infiltration data for site BR1.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
11	08	0.20	11.133	--	--	--	--
11	09	0.20	11.150	0.017	0.017	--	--
11	10	0.20	11.167	.017	.033	--	--
11	11	0.30	11.183	.017	.050	250	5.1
11	12	0.60	11.200	.017	.067	750	15.2
11	13	1.00	11.217	.017	.083	1,000	20.3
11	14	1.40	11.233	.017	.100	1,000	20.3
11	15	1.80	11.250	.017	.117	1,000	20.3
11	20	3.90	11.333	.083	.200	5,250	21.3
11	25	6.00	11.417	.083	.283	5,250	21.3
11	32	9.10	11.533	.117	.400	7,750	22.5
11	35	10.50	11.583	.050	.450	3,500	23.7
11	40	12.80	11.667	.083	.533	5,750	23.4
11	50	17.60	11.833	.167	.700	12,000	24.4
12	00	22.30	12.000	.167	.867	11,750	23.9
12	15	29.70	12.250	.250	1.117	18,500	25.0
12	30	36.90	12.500	.250	1.367	18,000	24.4
12	45	44.30	12.750	.250	1.617	18,500	25.0
12	50	46.80	12.833	.083	1.700	6,250	25.4
12	55	49.10	12.917	.083	1.783	5,750	23.4

| Penetration | |
Ring	Depth (inches)
Inner	3.5
Outer	2.5

| Constant water level | |
Ring	Depth (inches)
Inner	2.75
Outer	2.75

| Water temperature | |
Temperature (degrees Celsius)	Time
12.5	11:20
13.0	12:15
14.5	12:45

| Soil temperature | |
Temperature (degrees Celsius)	Depth (inches)
14.0	4.5

Comments: Inner ring initial fill depth 3 inches. Light rain/drizzle.

Appendix 2-8.   Infiltration data for site BR2.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
8	19	0.40	8.317	--	--	--	--
8	20	.40	8.333	0.017	0.017	--	--
8	21	.40	8.350	.017	.033	--	--
8	22	.40	8.367	.017	.050	--	--
8	23	.40	8.383	.017	.067	--	--
8	24	.40	8.400	.017	.083	--	--
8	25	.40	8.417	.017	.100	--	--
8	26	.40	8.433	.017	.117	--	--
8	27	.40	8.450	.017	.133	--	--
8	28	.40	8.467	.017	.150	--	--
8	29	.50	8.483	.017	.167	250	5.1
8	30	.60	8.500	.017	.183	250	5.1
8	31	.80	8.517	.017	.200	500	10.2
8	32	1.00	8.533	.017	.217	500	10.2
8	33	1.30	8.550	.017	.233	750	15.2
8	34	1.50	8.567	.017	.250	500	10.2
8	35	1.70	8.583	.017	.267	500	10.2
8	40	2.80	8.667	.083	.350	2,750	11.2
8	45	3.70	8.750	.083	.433	2,250	9.1
8	50	4.90	8.833	.083	.517	3,000	12.2
8	55	5.90	8.917	.083	.600	2,500	10.2
9	00	7.00	9.000	.083	.683	2,750	11.2
9	10	9.20	9.167	.167	.850	5,500	11.2
9	20	11.40	9.333	.167	1.017	5,500	11.2
9	30	13.70	9.500	.167	1.183	5,750	11.7
9	45	17.00	9.750	.250	1.433	8,250	11.2
10	00	20.30	10.000	.250	1.683	8,250	11.2
10	15	23.90	10.250	.250	1.933	8,999	12.2
10	31	27.40	10.517	.267	2.200	8,750	11.1
10	45	30.80	10.750	.233	2.433	8,500	12.3

| Penetration | |
Ring	Depth (inches)
Inner	3.5
Outer	2.5

| Constant water level | |
Ring	Depth (inches)
Inner	2.75
Outer	2.75

| Water temperature | |
Temperature (degrees Celsius)	Time
12.5	11:20
13.0	12:15
14.5	12:45

| Soil temperature | |
Temperature (degrees Celsius)	Depth (inches)
14.0	4.5

Comments: Inner ring initial fill depth 3 inches.

Appendix 2-9.   Infiltration data for site BR3.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

Time		Tube (units)	Time	Time		Incremental	
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
11	25	--	11.417	--	--	--	--
11	27	0.20	11.450	0.033	0.033	500	5.1
11	28	.40	11.467	.017	.050	500	10.2
11	29	.70	11.483	.017	.067	750	15.2
11	30	.90	11.500	.017	.083	500	10.2
11	31	1.10	11.517	.017	.100	500	10.2
11	32	1.30	11.533	.017	.117	500	10.2
11	33	1.60	11.550	.017	.133	750	15.2
11	34	1.80	11.567	.017	.150	500	10.2
11	35	2.00	11.583	.017	.167	500	10.2
11	40	3.30	11.667	.083	.250	3,250	13.2
11	45	4.30	11.750	.083	.333	2,500	10.2
11	50	5.30	11.833	.083	.417	2,500	10.2
11	55	6.40	11.917	.083	.500	2,750	11.2
12	00	7.40	12.000	.083	.583	2,500	10.2
12	15	10.80	12.250	.250	.833	8,500	11.5
12	30	14.20	12.500	.250	1.083	8,500	11.5
12	45	17.60	12.750	.250	1.333	8,500	11.5
13	00	21.10	13.000	.250	1.583	8,750	11.8
13	15	24.60	13.250	.250	1.833	8,750	11.8
13	30	28.30	13.500	.250	2.083	9,250	12.5
13	45	31.90	13.750	.250	2.333	8,999	12.2
14	00	35.60	14.000	.250	2.583	9,250	12.5
14	15	39.30	14.250	.250	2.833	9,249	12.5
14	30	42.90	14.500	.250	3.083	9,000	12.2
14	40	45.40	14.667	.167	3.250	6,250	12.7

Penetration	
Ring	Depth (inches)
Inner	4.2
Outer	3.3

Constant water level	
Ring	Depth (inches)
Inner	2.25
Outer	2.25

Water temperature	
Temperature (degrees Celsius)	Time
12.0	11:35
16.0	12:00
20.0	14:00

Soil temperature	
Temperature (degrees Celsius)	Depth (inches)
13.0	4.5

Comments: Inner ring initial fill depth 3 inches.

Appendix 2-10. Infiltration data for site AFB1.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
8	49	--	8.817	--	--	--	--
8	50	0.20	8.833	0.017	0.017	500	10.2
8	51	1.40	8.850	.017	.033	3,000	60.9
8	52	2.70	8.867	.017	.050	3,250	66.0
8	53	3.90	8.883	.017	.067	3,000	60.9
8	54	5.00	8.900	.017	.083	2,750	55.8
8	55	5.90	8.917	.017	.100	2,250	45.7
8	56	6.90	8.933	.017	.117	2,500	50.8
8	57	7.70	8.950	.017	.133	2,000	40.6
8	58	8.60	8.967	.017	.150	2,250	45.7
8	59	9.30	8.983	.017	.167	1,750	35.5
9	00	10.10	9.000	.017	.183	2,000	40.6
9	01	10.80	9.017	.017	.200	1,750	35.5
9	02	11.50	9.033	.017	.217	1,750	35.5
9	03	12.10	9.050	.017	.233	1,500	30.5
9	04	12.70	9.067	.017	.250	1,500	30.5
9	05	13.30	9.083	.017	.267	1,500	30.5
9	06	14.00	9.100	.017	.283	1,750	35.5
9	07	14.50	9.117	.017	.300	1,250	25.4
9	08	15.10	9.133	.017	.317	1,500	30.5
9	09	15.70	9.150	.017	.333	1,500	30.5
9	10	16.20	9.167	.017	.350	1,250	25.4
9	15	18.50	9.250	.083	.433	5,750	23.4
9	20	20.60	9.333	.083	.517	5,250	21.3
9	25	22.50	9.417	.083	.600	4,750	19.3
9	30	24.20	9.500	.083	.683	4,250	17.3
9	36	26.10	9.600	.100	.783	4,750	16.1
9	40	27.20	9.667	.067	.850	2,749	14.0
9	45	28.50	9.750	.083	.933	3,250	13.2
9	50	29.70	9.833	.083	1.017	3,000	12.2
9	55	30.90	9.917	.083	1.100	3,000	12.2
10	00	32.10	10.000	.083	1.183	3,000	12.2
10	05	33.20	10.083	.083	1.267	2,750	11.2
10	10	34.30	10.167	.083	1.350	2,749	11.2
10	15	35.40	10.250	.083	1.433	2,750	11.2
10	20	36.40	10.333	.083	1.517	2,500	10.2
10	25	37.30	10.417	.083	1.600	2,250	9.1
10	30	38.30	10.500	.083	1.683	2,500	10.2
10	35	39.30	10.583	.083	1.767	2,500	10.2

Appendix 2-10.   Infiltration data for site AFB1.—Continued

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
10	40	40.20	10.667	0.083	1.850	2,250	9.1
10	45	41.00	10.750	.083	1.933	1,999	8.1
10	50	41.90	10.833	.083	2.017	2,250	9.1
10	55	42.70	10.917	.083	2.100	2,000	8.1
11	00	43.40	11.000	.083	2.183	1,749	7.1
11	05	44.00	11.083	.083	2.267	1,500	6.1
11	10	44.60	11.167	.083	2.350	1,500	6.1

| Penetration | |
Ring	Depth (inches)
Inner	4.3
Outer	2.5

| Constant water level | |
Ring	Depth (inches)
Inner	3.25
Outer	3.25

| Water temperature | |
Temperature (degrees Celsius)	Time
16.0	09:01
18.0	09:55
21.0	11:00

| Soil temperature | |
Temperature (degrees Celsius)	Depth (inches)
13.5	4.5

Comments: Inner ring initial fill depth 3.5 inches.

Appendix 2-11.   Infiltration data for site AFB2.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
11	51	--	11.850	--	--	--	--
11	52	--	11.867	0.017	0.017	--	--
11	53	--	11.883	.017	.033	--	--
11	54	0.10	11.900	.017	.050	250	5.1
11	55	.50	11.917	.017	.067	1,000	20.3
11	56	1.10	11.933	.017	.083	1,500	30.5
11	57	1.80	11.950	.017	.100	1,750	35.5
11	58	2.50	11.967	.017	.117	1,750	35.5
11	59	3.20	11.983	.017	.133	1,750	35.5
12	00	3.90	12.000	.017	.150	1,750	35.5
12	05	7.10	12.083	.083	.233	8,000	32.5
12	10	10.30	12.167	.083	.317	8,000	32.5
12	15	13.50	12.250	.083	.400	8,000	32.5
12	20	16.40	12.333	.083	.483	7,250	29.4
12	25	19.30	12.417	.083	.567	7,250	29.4
12	30	21.90	12.500	.083	.650	6,499	26.4
12	35	24.30	12.583	.083	.733	6,000	24.4
12	40	26.60	12.667	.083	.817	5,750	23.4
12	45	28.70	12.750	.083	.900	5,249	21.3
12	50	30.70	12.833	.083	.983	5,000	20.3
12	55	32.70	12.917	.083	1.067	5,000	20.3
13	00	34.40	13.000	.083	1.150	4,249	17.3
13	05	36.10	13.083	.083	1.233	4,250	17.3
13	10	37.80	13.167	.083	1.317	4,249	17.3
13	15	39.30	13.250	.083	1.400	3,750	15.2
13	20	40.60	13.333	.083	1.483	3,250	13.2
13	25	43.10	13.417	.083	1.567	6,250	25.4
13	30	45.10	13.500	.083	1.650	5,000	20.3
13	31	45.40	13.517	.017	1.667	749	15.2
13	32	45.70	13.533	.017	1.683	750	15.2
13	33	46.00	13.550	.017	1.700	749	15.2
13	34	46.30	13.567	.017	1.717	749	15.2
13	36	46.90	13.600	.033	1.750	1,500	15.2
13	38	47.30	13.633	.033	1.783	999	10.1
13	40	47.70	13.667	.033	1.817	1,000	10.2

Appendix 2-11.   Infiltration data for site AFB2.—Continued

Penetration			Water temperature		
Ring	**Depth (inches)**		**Temperature (degrees Celsius)**	**Time**	
Inner	4.5		22.0	12:00	
Outer	3.0		25.0	12:45	
			26.0	13:34	
Constant water level					
Ring	**Depth (inches)**		**Soil temperature**		
Inner	2.25		**Temperature (degrees Celsius)**	**Depth (inches)**	
Outer	2.25		15.0	4.5	

Comments: Inner ring initial fill depth 3.5 inches. Flow interrupted 13:20.

Appendix 2-12.   Infiltration data for site GC1.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data; NA, not applicable]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
13	45	22.50	13.750	--	--	--	--
13	46	24.50	13.767	0.017	0.017	5,000	101.5
13	47	26.00	13.783	.017	.033	3,750	76.1
13	48	26.80	13.800	.017	.050	2,000	40.6
13	49	27.40	13.817	.017	.067	1,499	30.4
13	50	27.90	13.833	.017	.083	1,250	25.4
13	51	28.30	13.850	.017	.100	1,000	20.3
13	52	28.60	13.867	.017	.117	750	15.2
13	53	29.00	13.883	.017	.133	999	20.3
13	54	29.30	13.900	.017	.150	750	15.2
13	55	29.60	13.917	.017	.167	750	15.2
13	56	30.00	13.933	.017	.183	999	20.3
13	57	30.30	13.950	.017	.200	750	15.2
13	58	30.50	13.967	.017	.217	499	10.1
13	59	30.60	13.983	.017	.233	250	5.1
14	00	30.80	14.000	.017	.250	499	10.1
14	05	32.00	14.083	.083	.333	3,000	12.2
14	10	33.00	14.167	.083	.417	2,500	10.2

| Penetration | |
Ring	Depth (inches)
Inner	2.0
Outer	2.0

| Water temperature | |
Temperature (degrees Celsius)	Time
20.0	13:48
20.0	13:59

| Constant water level | |
Ring	Depth (feet)
Inner	0.50
Outer	0.50

| Soil temperature | |
Temperature (degrees Celsius)	Depth (inches)
NA	NA

Comments: No evidence of rings leaking.

Appendix 2-13.   Infiltration data for site GC2.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
9	52	2.20	9.867	--	--	--	--
9	54	2.40	9.900	0.033	0.033	499	5.1
9	56	2.90	9.933	.033	.067	1,250	12.7
9	58	3.40	9.967	.033	.100	1,250	12.7
10	00	3.90	10.000	.033	.133	1,250	12.7
10	02	4.60	10.033	.033	.167	1,750	17.8
10	04	5.20	10.067	.033	.200	1,500	15.2
10	06	5.90	10.100	.033	.233	1,750	17.8
10	08	7.00	10.133	.033	.267	2,750	27.9
10	10	8.10	10.167	.033	.300	2,750	27.9
10	15	10.80	10.250	.083	.383	6,750	27.4
10	20	13.20	10.333	.083	.467	6,000	24.4
10	25	14.10	10.417	.083	.550	2,250	9.1
10	30	14.80	10.500	.083	.633	1,750	7.1
10	32	15.20	10.533	.033	0.667	999	10.1
10	34	15.30	10.567	.033	0.700	250	2.5
10	36	15.60	10.600	.033	0.733	749	7.6
10	38	15.90	10.633	.033	0.767	750	7.6
10	40	16.60	10.667	.033	0.800	1,750	17.8
10	42	17.20	10.700	.033	0.833	1,499	15.2
10	44	17.90	10.733	.033	0.867	1,750	17.8
10	46	18.30	10.767	.033	0.900	1,000	10.2
10	48	18.70	10.800	.033	0.933	999	10.1
10	50	20.60	10.833	.033	0.967	4,750	48.2
10	52	24.20	10.867	.033	1.000	8,999	91.4
10	54	27.60	10.900	.033	1.033	8,500	86.3
10	56	30.80	10.933	.033	1.067	8,000	81.2
10	58	33.70	10.967	.033	1.100	7,250	73.6
11	00	36.30	11.000	.033	1.133	6,499	66.0
11	02	38.60	11.033	.033	1.167	5,750	58.4
11	04	40.60	11.067	.033	1.200	5,000	50.8
11	06	42.50	11.100	.033	1.233	4,750	48.2
11	08	43.70	11.133	.033	1.267	3,000	30.5
11	10	43.70	11.167	.033	1.300	--	--

Appendix 2-13. Infiltration data for site GC2.—Continued

Penetration		Water temperature	
Ring	**Depth (inches)**	**Temperature (degrees Celsius)**	**Time**
Inner	2.0	15.0	09:54
Outer	2.0	15.0	10:32
		16.5	11:00

Constant water level		Soil temperature	
Ring	**Depth (feet)**	**Temperature (degrees Celsius)**	**Depth (feet)**
Inner	0.30	14.0	0.4
Outer	0.30		

Comments: Inner-ring water level varied. Inner ring leak ~10:50. Debris in site tube.

Appendix 2-14.   Infiltration data for site GC3.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
12	09	0.70	12.150	--	--	--	--
12	14	4.30	12.233	0.083	0.083	9,000	36.5
12	15	6.30	12.250	.017	.100	5,000	101.5
12	16	7.30	12.267	.017	.117	2,500	50.8
12	17	8.30	12.283	.017	.133	2,500	50.8
12	18	9.30	12.300	.017	.150	2,500	50.8
12	19	10.10	12.317	.017	.167	2,000	40.6
12	20	10.90	12.333	.017	.183	2,000	40.6
12	21	11.70	12.350	.017	.200	2,000	40.6
12	23	13.20	12.383	.033	.233	3,750	38.1
12	25	14.70	12.417	.033	.267	3,750	38.1
12	27	16.20	12.450	.033	.300	3,750	38.1
12	29	17.40	12.483	.033	.333	3,000	30.5
12	31	18.60	12.517	.033	.367	3,000	30.5
12	33	19.80	12.550	.033	.400	3,000	30.5
12	36	21.50	12.600	.050	.450	4,250	28.8
12	39	23.20	12.650	.050	.500	4,250	28.8
12	42	24.60	12.700	.050	.550	3,500	23.7
12	45	26.10	12.750	.050	.600	3,750	25.4
12	48	27.60	12.800	.050	.650	3,750	25.4
12	51	29.00	12.850	.050	.700	3,500	23.7
12	54	30.20	12.900	.050	.750	3,000	20.3
12	58	31.90	12.967	.067	.817	4,250	21.6
13	02	33.50	13.033	.067	.883	4,000	20.3
13	06	35.00	13.100	.067	.950	3,750	19.0
13	10	36.50	13.167	.067	1.017	3,750	19.0
13	15	38.20	13.250	.083	1.100	4,250	17.3
13	20	39.80	13.333	.083	1.183	3,999	16.2
13	25	41.50	13.417	.083	1.267	4,250	17.3
13	30	43.20	13.500	.083	1.350	4,250	17.3

Penetration	
Ring	Depth (inches)
Inner	2.3
Outer	2.3

Constant water level	
Ring	Depth (feet)
Inner	0.25
Outer	0.25

Water temperature	
Temperature (degrees Celsius)	Time
18.0	12:14
21.5	12:23
26.5	13:25

Soil temperature	
Temperature (degrees Celsius)	Depth (feet)
14.0	0.4

Comments: No evidence of rings leaking. Debris in site tube initially.

Appendix 2-15. Infiltration data for site LG1.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
15	42	2.60	15.700	--	--	--	--
15	43	3.50	15.717	0.017	0.017	2,250	45.7
15	44	4.70	15.733	.017	.033	3,000	60.9
15	45	6.20	15.750	.017	.050	3,750	76.1
15	46	7.40	15.767	.017	.067	3,000	60.9
15	47	8.50	15.783	.017	.083	2,750	55.8
15	48	9.50	15.800	.017	.100	2,500	50.8
15	49	10.60	15.817	.017	.117	2,750	55.8
15	50	11.60	15.833	.017	.133	2,500	50.8
15	51	12.70	15.850	.017	.150	2,750	55.8
15	52	13.70	15.867	.017	.167	2,500	50.8
15	53	14.60	15.883	.017	.183	2,250	45.7
15	54	15.60	15.900	.017	.200	2,500	50.8
15	55	16.60	15.917	.017	.217	2,500	50.8
15	56	17.60	15.933	.017	.233	2,500	50.8
15	57	18.60	15.950	.017	.250	2,500	50.8
15	58	19.60	15.967	.017	.267	2,500	50.8
15	59	20.50	15.983	.017	.283	2,250	45.7
16	00	21.50	16.000	.017	.300	2,500	50.8
16	01	22.50	16.017	.017	.317	2,500	50.8
16	02	23.40	16.033	.017	.333	2,250	45.7
16	03	24.20	16.050	.017	.350	2,000	40.6
16	04	25.20	16.067	.017	.367	2,500	50.8
16	05	26.10	16.083	.017	.383	2,250	45.7
16	06	27.00	16.100	.017	.400	2,250	45.7
16	07	27.90	16.117	.017	.417	2,250	45.7
16	08	28.90	16.133	.017	.433	2,500	50.8
16	09	29.80	16.150	.017	.450	2,250	45.7
16	10	30.70	16.167	.017	.467	2,250	45.7
16	11	31.50	16.183	.017	.483	2,000	40.6
16	12	32.50	16.200	.017	.500	2,500	50.8
16	13	33.30	16.217	.017	.517	1,999	40.6
16	14	34.20	16.233	.017	.533	2,250	45.7
16	15	35.00	16.250	.017	.550	1,999	40.6
16	16	35.90	16.267	.017	.567	2,250	45.7
16	17	36.70	16.283	.017	.583	2,000	40.6
16	19	38.40	16.317	.033	.617	4,249	43.1
16	20	39.20	16.333	.017	.633	2,000	40.6
16	21	40.00	16.350	.017	.650	1,999	40.6

Appendix 2-15. Infiltration data for site LG1.—Continued

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
16	22	40.80	16.367	0.017	0.667	1,999	40.6
16	23	41.60	16.383	.017	.683	2,000	40.6
16	24	42.40	16.400	.017	.700	1,999	40.6
16	25	43.20	16.417	.017	.717	2,000	40.6
16	26	44.00	16.433	.017	.733	1,999	40.6
16	27	44.80	16.450	.017	.750	1,999	40.6
16	28	45.60	16.467	.017	.767	2,000	40.6
16	29	46.40	16.483	.017	.783	1,999	40.6
16	30	47.10	16.500	.017	.800	1,750	35.5
16	31	47.90	16.517	.017	.817	1,999	40.6
16	32	48.70	16.533	.017	.833	2,000	40.6

| Penetration | |
Ring	Depth (inches)
Inner	3.0
Outer	3.0

| Water temperature | |
Temperature (degrees Celsius)	Time
17.0	16:08
18.5	16:16
19.0	16:32

| Constant water level | |
Ring	Depth (feet)
Inner	0.20
Outer	0.20

| Soil temperature | |
Temperature (degrees Celsius)	Depth (inches)
18.0	4.0

Comments: None.

Appendix 2-16. Infiltration data for site LG2.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data; NA, not applicable]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
16	59	0.60	16.983	--	--	--	--
17	01	1.80	17.017	0.033	0.033	3,000	30.5
17	02	2.80	17.033	.017	.050	2,500	50.8
17	03	3.70	17.050	.017	.067	2,250	45.7
17	04	4.80	17.067	.017	.083	2,750	55.8
17	05	5.70	17.083	.017	.100	2,250	45.7
17	06	6.50	17.100	.017	.117	2,000	40.6
17	07	7.40	17.117	.017	.133	2,250	45.7
17	08	8.10	17.133	.017	.150	1,750	35.5
17	09	9.00	17.150	.017	.167	2,250	45.7
17	10	9.50	17.167	.017	.183	1,250	25.4
17	11	10.20	17.183	.017	.200	1,750	35.5
17	12	10.90	17.200	.017	.217	1,750	35.5
17	13	11.60	17.217	.017	.233	1,750	35.5
17	14	12.40	17.233	.017	.250	2,000	40.6
17	15	13.20	17.250	.017	.267	2,000	40.6
17	16	14.00	17.267	.017	.283	2,000	40.6
17	17	14.70	17.283	.017	.300	1,750	35.5
17	18	15.50	17.300	.017	.317	2,000	40.6
17	19	16.30	17.317	.017	.333	2,000	40.6
17	20	17.10	17.333	.017	.350	2,000	40.6
17	22	18.50	17.367	.033	.383	3,500	35.5
17	24	20.00	17.400	.033	.417	3,750	38.1
17	26	21.60	17.433	.033	.450	4,000	40.6
17	28	23.00	17.467	.033	.483	3,500	35.5
17	30	24.40	17.500	.033	.517	3,500	35.5
17	32	25.80	17.533	.033	.550	3,500	35.5
17	34	27.20	17.567	.033	.583	3,500	35.5
17	36	28.60	17.600	.033	.617	3,500	35.5
17	38	30.00	17.633	.033	.650	3,500	35.5
17	40	31.30	17.667	.033	.683	3,250	33.0
17	42	32.70	17.700	.033	.717	3,500	35.5
17	43	33.40	17.717	.017	.733	1,749	35.5
17	45	34.70	17.750	.033	.767	3,250	33.0
17	47	36.00	17.783	.033	.800	3,249	33.0
17	49	37.20	17.817	.033	.833	3,000	30.5
17	51	38.50	17.850	.033	.867	3,249	33.0
17	53	39.80	17.883	.033	.900	3,249	33.0
17	55	41.10	17.917	.033	.933	3,250	33.0

Appendix 2-16.   Infiltration data for site LG2.—Continued

Penetration	
Ring	**Depth (inches)**
Inner	3.0
Outer	3.0

Constant water level	
Ring	**Depth (feet)**
Inner	0.20
Outer	0.20

Water temperature	
Temperature (degrees Celsius)	**Time**
17.5	17:08
17.5	17:32
18.0	17:55

Soil temperature	
Temperature (degrees Celsius)	**Depth (inches)**
NA	NA

Comments: None.

Appendix 2-17.   Infiltration data for site LG3.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
9	23	1.60	9.383	--	--	--	--
9	24	5.50	9.400	0.017	0.017	9,750	198.0
9	25	8.40	9.417	.017	.033	7,250	147.2
9	26	10.90	9.433	.017	.050	6,250	126.9
9	27	12.90	9.450	.017	.067	5,000	101.5
9	28	14.70	9.467	.017	.083	4,500	91.4
9	29	16.40	9.483	.017	.100	4,250	86.3
9	30	18.00	9.500	.017	.117	4,000	81.2
9	31	19.60	9.517	.017	.133	4,000	81.2
9	32	21.30	9.533	.017	.150	4,250	86.3
9	33	22.90	9.550	.017	.167	3,999	81.2
9	34	24.50	9.567	.017	.183	4,000	81.2
9	35	26.10	9.583	.017	.200	4,000	81.2
9	36	27.70	9.600	.017	.217	3,999	81.2
9	37	29.40	9.617	.017	.233	4,250	86.3
9	38	31.00	9.633	.017	.250	4,000	81.2
9	39	32.60	9.650	.017	.267	4,000	81.2
9	40	34.20	9.667	.017	.283	4,000	81.2
9	41	35.70	9.683	.017	.300	3,750	76.1
9	42	37.40	9.700	.017	.317	4,249	86.3
9	43	38.90	9.717	.017	.333	3,750	76.1
9	44	40.30	9.733	.017	.350	3,500	71.1
9	45	41.80	9.750	.017	.367	3,750	76.1
9	46	43.50	9.767	.017	.383	4,250	86.3
9	47	45.00	9.783	.017	.400	3,750	76.1
9	48	46.40	9.800	.017	.417	3,500	71.1
9	49	48.00	9.817	.017	.433	4,000	81.2
9	50	49.50	9.833	.017	.450	3,750	76.1

Penetration	
Ring	Depth (inches)
Inner	2.3
Outer	2.3

Constant water level	
Ring	Depth (feet)
Inner	0.28
Outer	0.20

Water temperature	
Temperature (degrees Celsius)	Time
12.5	09:31
12.5	09:41
12.5	09:49

Soil temperature	
Temperature (degrees Celsius)	Depth (feet)
13.0	0.4

Comments: None.

Appendix 2-18.   Infiltration data for site LG4.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data; NA, not applicable]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
11	20	0.90	11.333	--	--	--	--
11	21	1.70	11.350	0.017	0.017	2,000	40.6
11	22	2.30	11.367	.017	.033	1,500	30.5
11	23	4.30	11.383	.017	.050	5,000	101.5
11	24	6.00	11.400	.017	.067	4,250	86.3
11	25	7.60	11.417	.017	.083	4,000	81.2
11	26	8.80	11.433	.017	.100	3,000	60.9
11	27	10.20	11.450	.017	.117	3,500	71.1
11	28	11.20	11.467	.017	.133	2,500	50.8
11	29	12.30	11.483	.017	.150	2,750	55.8
11	30	13.40	11.500	.017	.167	2,750	55.8
11	31	14.40	11.517	.017	.183	2,500	50.8
11	32	15.20	11.533	.017	.200	2,000	40.6
11	34	17.10	11.567	.033	.233	4,750	48.2
11	35	18.00	11.583	.017	.250	2,250	45.7
11	36	18.90	11.600	.017	.267	2,250	45.7
11	37	19.70	11.617	.017	.283	2,000	40.6
11	38	20.50	11.633	.017	.300	2,000	40.6
11	40	22.10	11.667	.033	.333	4,000	40.6
11	42	23.60	11.700	.033	.367	3,750	38.1
11	44	25.10	11.733	.033	.400	3,750	38.1
11	46	26.40	11.767	.033	.433	3,249	33.0
11	48	27.90	11.800	.033	.467	3,750	38.1
11	50	29.30	11.833	.033	.500	3,500	35.5
11	52	30.50	11.867	.033	.533	3,000	30.5
11	54	31.90	11.900	.033	.567	3,500	35.5
11	56	33.10	11.933	.033	.600	3,000	30.5
11	58	34.40	11.967	.033	.633	3,249	33.0
12	00	35.60	12.000	.033	.667	3,000	30.5
12	03	37.40	12.050	.050	.717	4,499	30.5
12	05	38.60	12.083	.033	.750	3,000	30.5
12	07	39.70	12.117	.033	.783	2,750	27.9
12	09	40.80	12.150	.033	.817	2,749	27.9
12	12	42.40	12.200	.050	.867	4,000	27.1
12	14	43.60	12.233	.033	.900	3,000	30.5
12	16	44.60	12.267	.033	.933	2,500	25.4
12	18	45.80	12.300	.033	.967	2,999	30.4
12	20	46.80	12.333	.033	1.000	2,500	25.4
12	22	47.80	12.367	.033	1.033	2,500	25.4
12	24	48.80	12.400	.033	1.067	2,500	25.4

Appendix 2-18. Infiltration data for site LG4.—Continued

Penetration		Water temperature	
Ring	**Depth (inches)**	**Temperature (degrees Celsius)**	**Time**
Inner	4.0	16.0	11:34
Outer	4.0	16.5	11:42
		17.0	12:14

Constant water level		Soil temperature	
Ring	**Depth (feet)**	**Temperature (degrees Celsius)**	**Depth (inches)**
Inner	0.20	NA	NA
Outer	0.18		

Comments: None.

Appendix 2-19. Infiltration data for site DC1.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

Time				Time		Incremental	
hrs	min	Tube (units)	Time	Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
9	28	0.40	9.467	--	--	--	--
9	29	1.70	9.483	0.017	0.017	3,250	66.0
9	30	3.60	9.500	.017	.033	4,750	96.4
9	31	4.90	9.517	.017	.050	3,250	66.0
9	32	6.00	9.533	.017	.067	2,750	55.8
9	33	6.90	9.550	.017	.083	2,250	45.7
9	34	7.70	9.567	.017	.100	2,000	40.6
9	35	8.30	9.583	.017	.117	1,500	30.5
9	36	8.90	9.600	.017	.133	1,500	30.5
9	37	9.50	9.617	.017	.150	1,500	30.5
9	38	10.00	9.633	.017	.167	1,250	25.4
9	39	10.50	9.650	.017	.183	1,250	25.4
9	40	10.90	9.667	.017	.200	1,000	20.3
9	41	11.30	9.683	.017	.217	1,000	20.3
9	42	11.50	9.700	.017	.233	499	10.1
9	43	11.90	9.717	.017	.250	1,000	20.3
9	44	12.20	9.733	.017	.267	749	15.2
9	45	12.50	9.750	.017	.283	750	15.2
9	46	12.80	9.767	.017	.300	750	15.2
9	47	13.10	9.783	.017	.317	749	15.2
9	48	13.30	9.800	.017	.333	500	10.2
9	49	13.60	9.817	.017	.350	749	15.2
9	50	13.90	9.833	.017	.367	750	15.2
9	51	14.10	9.850	.017	.383	499	10.1
9	52	14.30	9.867	.017	.400	500	10.2
9	53	14.50	9.883	.017	.417	499	10.1
9	54	14.70	9.900	.017	.433	499	10.1
9	55	15.00	9.917	.017	.450	750	15.2

Penetration	
Ring	Depth (inches)
Inner	3.0
Outer	3.0

Constant water level	
Ring	Depth (feet)
Inner	0.20
Outer	0.18

Water temperature	
Temperature (degrees Celsius)	Time
18.0	09:33
18.0	09:31
17.0	09:55

Soil temperature	
Temperature (degrees Celsius)	Depth (feet)
8.0	0.4

Comments: Inner-ring water level increased at test end.

Appendix 2-20.   Infiltration data for site DC2.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data; NA, not applicable]

Time				Time		Incremental	
hrs	min	Tube (units)	Time	Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
10	28	0.20	10.467	--	--	--	--
10	29	2.30	10.483	0.017	0.017	5,250	106.6
10	30	5.30	10.500	.017	.033	7,500	152.3
10	31	7.00	10.517	.017	.050	4,250	86.3
10	32	8.10	10.533	.017	.067	2,750	55.8
10	33	9.00	10.550	.017	.083	2,250	45.7
10	34	9.80	10.567	.017	.100	2,000	40.6
10	35	10.50	10.583	.017	.117	1,750	35.5
10	37	11.70	10.617	.033	.150	3,000	30.5
10	38	12.20	10.633	.017	.167	1,250	25.4
10	39	12.70	10.650	.017	.183	1,250	25.4
10	40	13.20	10.667	.017	.200	1,250	25.4
10	41	13.60	10.683	.017	.217	1,000	20.3
10	42	14.00	10.700	.017	.233	1,000	20.3
10	43	14.40	10.717	.017	.250	1,000	20.3
10	44	14.70	10.733	.017	.267	749	15.2
10	45	15.10	10.750	.017	.283	1,000	20.3
10	46	15.40	10.767	.017	.300	750	15.2
10	47	15.70	10.783	.017	.317	749	15.2
10	48	16.00	10.800	.017	.333	750	15.2
10	49	16.20	10.817	.017	.350	499	10.1
10	50	16.40	10.833	.017	.367	499	10.1
10	51	16.70	10.850	.017	.383	750	15.2
10	52	16.90	10.867	.017	.400	499	10.1
10	53	17.10	10.883	.017	.417	500	10.2
10	54	17.40	10.900	.017	.433	749	15.2
10	55	17.60	10.917	.017	.450	500	10.2

Penetration	
Ring	Depth (inches)
Inner	3.3
Outer	3.3

Constant water level	
Ring	Depth (feet)
Inner	0.25
Outer	0.25

Water temperature	
Temperature (degrees Celsius)	Time
18.0	10:32
18.0	10:46
18.0	10:49

Soil temperature	
Temperature (degrees Celsius)	Depth (inches)
NA	NA

Comments: Inner-ring water level increased at test end.

Appendix 2-21.   Infiltration data for site SP1.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
13	15	0.30	13.250	--	--	--	--
13	17	5.80	13.283	0.033	0.033	13,750	139.6
13	18	9.60	13.300	.017	.050	9,500	192.9
13	19	12.00	13.317	.017	.067	6,000	121.8
13	20	13.70	13.333	.017	.083	4,250	86.3
13	21	15.00	13.350	.017	.100	3,250	66.0
13	22	16.00	13.367	.017	.117	2,500	50.8
13	23	17.00	13.383	.017	.133	2,500	50.8
13	24	18.00	13.400	.017	.150	2,500	50.8
13	25	19.10	13.417	.017	.167	2,750	55.8
13	26	20.10	13.433	.017	.183	2,500	50.8
13	27	21.00	13.450	.017	.200	2,250	45.7
13	28	22.00	13.467	.017	.217	2,500	50.8
13	29	23.00	13.483	.017	.233	2,500	50.8
13	30	24.00	13.500	.017	.250	2,500	50.8
13	31	25.00	13.517	.017	.267	2,500	50.8
13	32	25.90	13.533	.017	.283	2,250	45.7
13	33	26.90	13.550	.017	.300	2,500	50.8
13	34	27.80	13.567	.017	.317	2,250	45.7
13	35	28.70	13.583	.017	.333	2,250	45.7
13	36	29.60	13.600	.017	.350	2,250	45.7
13	37	30.50	13.617	.017	.367	2,250	45.7
13	38	31.40	13.633	.017	.383	2,250	45.7
13	39	32.20	13.650	.017	.400	2,000	40.6
13	40	33.10	13.667	.017	.417	2,250	45.7
13	41	34.00	13.683	.017	.433	2,250	45.7
13	42	34.90	13.700	.017	.450	2,250	45.7
13	43	35.70	13.717	.017	.467	2,000	40.6
13	44	36.50	13.733	.017	.483	1,999	40.6
13	45	37.40	13.750	.017	.500	2,250	45.7
13	46	38.20	13.767	.017	.517	2,000	40.6
13	47	39.00	13.783	.017	.533	1,999	40.6
13	48	39.90	13.800	.017	.550	2,250	45.7
13	49	40.70	13.817	.017	.567	2,000	40.6
13	50	41.50	13.833	.017	.583	1,999	40.6
13	51	42.30	13.850	.017	.600	1,999	40.6
13	52	43.20	13.867	.017	.617	2,250	45.7
13	53	44.30	13.883	.017	.633	2,749	55.8
13	55	45.60	13.917	.033	.667	3,250	33.0

Appendix 2-21.   Infiltration data for site SP1.—Continued

Penetration	
Ring	**Depth (inches)**
Inner	5.0
Outer	5.0

Constant water level	
Ring	**Depth (feet)**
Inner	0.20
Outer	0.18

Water temperature	
Temperature (degrees Celsius)	**Time**
20.0	13:19
21.0	13:34
21.0	13:53

Soil temperature	
Temperature (degrees Celsius)	**Depth (feet)**
9.5	0.4

Comments: None.

Appendix 2-22.   Infiltration data for site SP2.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data; NA, not applicable]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
14	34	0.10	14.567	--	--	--	--
14	35	2.70	14.583	0.017	0.017	6,500	132.0
14	36	4.50	14.600	.017	.033	4,500	91.4
14	37	5.50	14.617	.017	.050	2,500	50.8
14	38	6.20	14.633	.017	.067	1,750	35.5
14	39	6.80	14.650	.017	.083	1,500	30.5
14	40	7.30	14.667	.017	.100	1,250	25.4
14	41	7.80	14.683	.017	.117	1,250	25.4
14	42	8.40	14.700	.017	.133	1,500	30.5
14	43	8.90	14.717	.017	.150	1,250	25.4
14	44	9.40	14.733	.017	.167	1,250	25.4
14	45	9.90	14.750	.017	.183	1,250	25.4
14	46	10.30	14.767	.017	.200	1,000	20.3
14	47	10.70	14.783	.017	.217	999	20.3
14	48	11.10	14.800	.017	.233	1,000	20.3
14	49	11.50	14.817	.017	.250	1,000	20.3
14	50	11.90	14.833	.017	.267	1,000	20.3
14	51	12.30	14.850	.017	.283	1,000	20.3
14	52	12.70	14.867	.017	.300	999	20.3

| Penetration | |
Ring	Depth (inches)
Inner	3.0
Outer	3.0

| Water temperature | |
Temperature (degrees Celsius)	Time
22.0	14:42
22.0	14:49

| Constant water level | |
Ring	Depth (feet)
Inner	0.20
Outer	0.20

| Soil temperature | |
Temperature (degrees Celsius)	Depth (inches)
NA	NA

Comments: None.

Appendix 2-23.   Infiltration data for site SP3.

[hrs, hours; min, minutes; mL, milliliters; cm/hr, centimeters per hour; --, no data; NA, not applicable]

| Time | | Tube (units) | Time | Time | | Incremental | |
hrs	min			Interval (hrs)	Elapsed (hrs)	Volume (mL)	Velocity (cm/hr)
15	23	0.30	15.383	--	--	--	--
15	24	4.50	15.400	0.017	0.017	10,500	213.2
15	25	8.20	15.417	.017	.033	9,250	187.8
15	26	11.00	15.433	.017	.050	7,000	142.1
15	27	13.40	15.450	.017	.067	6,000	121.8
15	28	15.40	15.467	.017	.083	5,000	101.5
15	29	17.40	15.483	.017	.100	5,000	101.5
15	30	19.20	15.500	.017	.117	4,500	91.4
15	31	21.00	15.517	.017	.133	4,500	91.4
15	32	22.70	15.533	.017	.150	4,250	86.3
15	33	24.40	15.550	.017	.167	4,250	86.3
15	34	26.00	15.567	.017	.183	4,000	81.2
15	35	27.60	15.583	.017	.200	4,000	81.2
15	36	29.20	15.600	.017	.217	3,999	81.2
15	37	30.80	15.617	.017	.233	4,000	81.2
15	38	32.40	15.633	.017	.250	3,999	81.2
15	39	33.80	15.650	.017	.267	3,500	71.1
15	40	35.30	15.667	.017	.283	3,750	76.1
15	41	36.80	15.683	.017	.300	3,750	76.1
15	42	38.20	15.700	.017	.317	3,500	71.1
15	43	39.70	15.717	.017	.333	3,750	76.1
15	44	41.10	15.733	.017	.350	3,500	71.1
15	45	42.50	15.750	.017	.367	3,500	71.1
15	46	43.80	15.767	.017	.383	3,249	66.0
15	47	45.10	15.783	.017	.400	3,250	66.0
15	48	46.50	15.800	.017	.417	3,500	71.1
15	49	47.80	15.817	.017	.433	3,249	66.0

Penetration	
Ring	Depth (inches)
Inner	3.0
Outer	3.0

Water temperature	
Temperature (degrees Celsius)	Time
20.0	15:29
20.5	15:40

Constant water level	
Ring	Depth (feet)
Inner	0.20
Outer	0.16

Soil temperature	
Temperature (degrees Celsius)	Depth (inches)
NA	NA

Comments: None.